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The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

IN THE MATTER OF THE GAS RESOURCES PRESERVATION ACT

AND IN THE MATTER of a Joint Hearing to determine various questions relating to the proposed Export of Natural Gas from the Province of Alberta.

I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session: September 27th, 1951.

Volume 12.

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I N D E X

VOLUME 12

September 27, 1951.

W I T N E S S E S

Volume 12.
Sept. 27/51.

E X H I B I T S

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VOLUME 12.

27 September 1951.

MR. NOLAN: Mr. Chairman and members of the Board, on behalf of the companies which I represent, namely, the Northwest Natural Gas Company, Alberta Natural Gas Grid Limited and Alberta Natural Gas Company, I desire, with the permission of the Board, to call Mr. Dixon to make a brief introductory statement in the course of which he will outline to the Board the nature and the scope of the submissions that we intend to present. I do not offer that statement as an exhibit, Mr. Chairman, but I had it reproduced in sufficient numbers that it may be distributed to all interested parties and applicants for their convenience and for the convenience, of course, of the Board. So with your permission I will distribute the copies of the statement now and ask Mr. Dixon to go into the witness-stand.

A. FAISON DIXON, having been first duly sworn, examined by Mr. Nolan, testified as follows:

MR. NOLAN: Mr. Chairman, Mr. Dixon has appeared on several occasions before the Board during the course of these Hearings. He has been sworn so I will not say anything about his qualifications, which are a matter of record.

THE CHAIRMAN: Yes.

Q MR. NOLAN: Mr. Dixon, would you be good enough to read the introductory statement on behalf of

our three companies?

A Two years ago, in August, 1949, Northwest Natural Gas Company made application to this Board for permission to export 80 billion cubic feet of natural gas annually from Alberta. This application set forth the plan to construct an integrated natural gas gathering system and a transmission line through the Crow's Nest Pass to British Columbia and the Pacific Northwest. Detailed evidence on all aspects of this project was presented to the Board in June, 1950, and at the Joint Hearing in October, 1950. That plan is our present plan. We assume that the Board would not wish us to burden the records with repetitious testimony.

Since steel is now being allocated, it may not be possible to construct the entire grid system as contemplated until more urgent requirements have been met. Consequently, Northwest Natural Gas Company plans initially to take gas from the most accessible fields and, when restrictions on the use of steel pipe are lifted, to extend the grid system as circumstances warrant. In connection with this modification, Dr. A. D. Brokaw will submit an exhibit illustrating how the requirements of Northwest Natural Gas Company could be met from Pincher Creek, Many Island Lake and fields in the general vicinity of Princess. We would, of course, with the approval of the Board, take gas from other fields in this area, including the Pakowki Lake region and the Cessford field, if the owners so desire.

The price we have discussed with certain

producers is 10¾ cents per Mcf. for gas gathered and delivered into the line at 750 pounds pressure. In addition, there will be a price increase each year of ¼ cent per Mcf. and other adjustments, for a period of twenty years. This price should insure the development of some fields that, at a lower price, would be regarded as submarginal.

In Exhibit No. J-13 of the Joint Hearing we estimated the requirements of the Edmonton and Calgary utility systems, together with possible additional consumers over the period of 1951-1980, to be 2.14 trillion cubic feet. We outlined in detail a method whereby these requirements, together with those of Northwest Natural Gas Company for twenty years, could be met from the then known reserves by means of an integrated gathering system. This market estimate of 2.14 trillion cubic feet did not encompass other areas of the Province and compares with that of 2.79 trillion cubic feet given by the Board in its Interim Report.

We know of no unexpected change since our market estimate was submitted to afford us any concrete basis for making new estimates, and any such amendment on our part would be in the nature of a pure guess, especially as far as potential industrial market is concerned. The market estimate given by the Board, namely, 2.79 trillion cubic feet, is some 0.65 trillion cubic feet in excess of our own, but since the Joint Hearing estimated reserves have increased by far more than this difference. As pointed out by other witnesses,

the problem of supplying the local utilities is one of constantly changing character, and in view of the present exploratory program time is a very favorable element. We have already outlined a general method of approach and do not feel that any new submission encompassing the relatively minor variants will be of assistance to the Board. It should be noted that the schedules presented in Exhibits Nos. J-13 and J-14 were based on proven and probable reserves as estimated at that time, and that in the intervening period substantial new discoveries have been made and further development has increased the reserves of some of the earlier discoveries.

MR. NOLAN: Mr. Chairman, those two exhibits, J-13 and J-14, should read J-12 and J-13.

THE WITNESS: Voluminous evidence has been presented to the Board on the subject of reserves, and except for a few instances the majority of the experts appear to be in fair agreement. There are, however, other factors of general significance that should be considered, namely:

(i) To a large extent these reserves have little prospect of finding an early market within the Province.

(ii) The two major distributing systems apparently have not felt that the situation is such as to justify the expense of acquiring the full reserves necessary to meet their estimated thirty-year requirements.

In view of the dynamic nature of the Alberta petroleum industry, this appears to be in line with good business practice for the utilities. The evidence of Mr. W.D.C. Mackenzie of Imperial Oil Limited indicates that the Edmonton system is receiving distress gas from Leduc. Even today gas is being wasted in this field, and as Mr. Ralph E. Davis pointed out, there is a possibility of "another Leduc" with a good gas cap being found within 50 to 75 miles of Edmonton. The prospects offered by Bailey Olds No. 1 and Shell Mackid are examples of how conveniently located sources of supply for these utilities could change the situation in a very short period.

A feature of paramount importance in looking to the future is the trend of discovery and development of natural gas prospects and the attendant increases in reserves since the discovery of the Leduc Field in 1947. With few exceptions these important additions have been incidental to the search for oil, with scant incentive to follow up gas discoveries by step-out drilling to delineate the fields and establish reserves. Meanwhile, activity in the acquisition of reservations, the prosecution of geophysical surveys and the drilling of wildcat tests promises to continue unabated for a period of years.

Dr. Brokaw will present an exhibit entitled "Data on the Trend of Natural Gas Discoveries in the Province of Alberta". Testimony submitted to the Dinning Commission and to this Board predicted that the

aggressive campaign of exploration would so extend the gas reserves that there would be a surplus in the Province. Events have justified these expectations.

Q Mr. Dixon, during the Joint Hearing which was held last year, and I think during the month of October, you presented an exhibit to the Board which is marked as J-13?

A Yes, sir.

Q And that exhibit set out the requirements and supply of natural gas for Alberta and other markets?

A Yes, sir.

Q And in the course of that, included in that exhibit was a discussion about the Leduc-Woodbend field?

A Yes, sir.

Q Have you anything that you would like to say to the Board today about the Leduc-Woodbend field in the light of our experience since the presentation of J-13?

A Developments there indicate that as near as we can find out, and I think we have enough figures to show, that the oil-gas ratio is increasing somewhat the way it was prophecied. And at the present time, there is somewhat more than half of the gas that comes from Leduc flared into the air. If all the gas of Leduc was being used in the nearby market at the present time in the summer months, or in the summer months, there would be but small need to be taking any reserves from the Kinsella field. I think the Leduc reserve is of very great importance in any discussion of fulfilling the requirements of the Province. That is a place where it either will be used or wasted.

Q All right, thank you, Mr. Dixon. That is all I have to ask the witness.

THE CHAIRMAN: Does anyone wish to question Mr. Dixon?

CROSS-EXAMINATION BY MR. McDONALD:

Q Just one question, Mr. Chairman. Mr. Dixon, at the bottom of page 1 of your statement, you use the words:

"there will be a price increase each year of ¼ cents per Mcf,"

would that be commencing the second year or the fifth year?

A Well, we have not completed any negotiations so I can not say.

Q May be the second and it may be the fifth?

A There may be other adjustments besides. I just wanted to give a general idea of what the discussions have been.

EXAMINATION BY MR. C.E. SMITH:

Q Mr. Dixon, have you any solution for the difficulties in Leduc as we presently see them? You just mentioned that your figure was about 50 per cent.

A Build a larger plant and utilize all the gas in the local market.

Q Anything else except a larger plant? Is there any other solution?

A Well, in theory you can put the gas back in the ground but that is, I believe, generally accepted to be an impossibility or impracticability because of costs.

Q Well, to avoid what I should call waste, for want of a better term, the larger plant idea is the only one you have in mind at the moment?

A The other way is to shut down the production of oil.

Q I was wondering if somebody would say that out loud.

EXAMINATION BY DR. GOVIER:

Q Mr. Dixon, your refer on page 2 of your statement to a figure of 2.79 trillion feet given by the Board in its Interim Report. Now, I have been unable to locate that figure, Mr. Dixon.

MR. NOLAN: Page 42. That figure is arrived at by adding together Canadian Western requirements of 1 trillion 1239, and the Northwestern Utility requirements of 1 trillion 553, on page 42.

DR. GOVIER: Thank you.

Q There is one other question, Mr. Dixon. I believe that the recent monthly reports to the Board have reflected a fact that some 60 per cent of the gas produced in the Leduc-Woodbend field is presently reaching a market. Where did you get your information that more than half of the gas is flared?

A From the monthly report. It was just about an even break.

Q I see.

A Now, the oil-gas ratio there, as near as we can get the figures for the D-2, has changed from 632 in July 1950 to 675 in July 1951.

Q Is that the D-2?

A That is the D-2.

Q Did you compute those figures from the monthly report, Mr. Dixon?

A Yes, sir. And from the D-3 from 561 to 578.

Q Over the same period?

A Over the same period.

Q Mr. Dixon, have you enquired even in a general way into the economics of picking up some of the gas which is now being flared and which is being produced, say, at the fringe of the pool?

A In a general way, yes. It would be costly. I do not think all of the gas there could ever be economically put into a plant but it did seem to me, just in driving around Leduc, there were some flares there, and especially if they had had a hole where you could really use them, it certainly would be worth gathering, just from a visual inspection of the place.

Q Did you have in mind any percentage of the total gas production that might be practical to have picked up?

A No. I just would think it would be more than it is at present. That is all I can say.

Q Thank you.

EXAMINATION BY THE CHAIRMAN:

Q Mr. Dixon, in regard to the Leduc field, we are very interested in your comment. I might say that the Board has been giving the matter very serious consideration and we have been pressing both the operators in the field and the operators of the processing plant to have as much

of this gas picked up and processed as possible. I understand, however, that they have run into some difficulties in the way of getting compressors and steel for gathering lines, and that has been lifted at the present time. But can you tell me of any other field of a similar nature to Leduc where quicker progress has been made in the way of gathering gas?

A Well, there is great difficulty everywhere now in getting steel, and in the Permean Basin on account of difficulty in getting the steel, the compressors and all the equipment necessary, there is a vast amount of gas blowing to the air right at the present time. Although the plans are to increase it in practically all the fields there they have been very strict when the steel was available and a market. They have even threatened to shut down fields if they did not do it and have shut them down considerably in West Texas.

(Go to page 957)

Q Yes?

A But now with the lack of steel and the great desire to get oil, all the oil they can, they are letting a great deal of gas blow to the air. I think they are doing just as well in Leduc as anywhere.

Q I mean, we are trying to get the situation remedied as quickly as possible, and in line with good economics as well.

A You cannot ever be perfect.

Q No, but I just wondered if you knew of any field where greater progress has been made in gathering the percentage of gas that has been gathered since the time it was discovered, and was being developed?

A No, I cannot name any field. Of course, there are some people, when they start on the decline, where all the gas is gathered, then your economics are a little different. You have already got your equipment there, and all the gas is saved, but in an expanding field, there is always a very considerable waste of gas, that is inevitable.

Q And as far as the market is concerned, there will be no market for the gas?

A As things stand now, I do not know just what market it could go to except into Edmonton.

Q Yes?

A And that would be absorbed, the present production, more or less, not quite, but a large part of it.

Q I think if there is more gas produced and processed we will certainly see that that gas is utilized, it would not be flared once it goes through processing?

A Well, if it is as much as we expect, and other fields come

in, some outlet will necessarily have to be found.

Q Well, we will look into that in the future.

MR.MAHAFFY: Mr.Chairman, may I ask the withess one or two questions, please?

THE CHAIRMAN: Yes.

.....

CROSS-EXAMINATION BY MR.MAHAFFY:

Q Mr. Dixon, in the second paragraph of your written memorandum you refer to a gathering system, and you say that because of the present shortage of steel that you did not propose to construct the entire grid system as contemplated? Now, assuming that steel is available, or is available in the near future, would you construct some further system than you suggest here?

A Yes, sir.

Q And what fields would you plan to connect?

A Well, that will depend on the development. A line first as far as the general region of wells, let us say, McKidd, or that far.

Q Pardon?

A Take a line going out past or close to Calgary, and we might take then any excess of gas that might be available from Jumping Pound if it is not required in Calgary.

Q Yes?

A And we think there will be a very considerable development either in McKidd or in the Bailey Olds well, Now, that would be one possibility. The others would be to Cessford and Pakowki Lake, if they wished to sell any gas, and we would like to extend it down there, and, eventually,

if there was excess gas that needed to be taken, we would build all the way to the Leduc Field and take any gas from north of there to the Legal Field, and that part that might be necessary. We expect to build our grid system, which has already been testified to, extensively as soon as it is possible.

Q Yes, and if the steel were available would you do this construction before or at the same time that you proceeded with your transport line? Would you, Mr. Dixon?

A Yes, that is right. Of course, we would do it a little slow, because during the first year of the line or so it does not sell a great amount of gas and there would be no necessity for hurry, as it would be no good to have it then no matter what you did, so that to delay a while is always advantageous on account of you do not know exactly where you want to go on account of the development, but the general plan is what we contemplate to do as soon as the market is to its full extent.

Q And steel is available?

A Ahd steel is available, yes.

Q Thank you.

THE CHAIRMAN: Thanks, Mr.Dixon.

MR.NOLAN: Now, Mr. Chairman, as Mr.Dixon has told the Board, it is our desire now to ask Dr. Brokaw to present his submission. Dr. Brokaw, will you please take the stand? We have made a distribution of the first brief, and if the members of the Board have not their copies, I have extra copies available.

THE CHAIRMAN: We have copies. That will be marked Exhibit 28.

MR.NOLAN: That is the supplementary deliverability study of certain Alberta gas fields.

THE CHAIRMAN: Yes, Exhibit 28.

SUPPLEMENTARY DELIVERABILITY STUDY OF CERTAIN ALBERTA GAS FIELDS BY DR.BROKAW MARKED EXHIBIT 28.

.....

ALBERT D. BROKAW, having been duly sworn, examined by Mr. Nolan, testified as follows:-

Q Dr. Brokaw has also been before the Board on several occasions, so that I will make no mention of his academic qualifications or his professional background, but merely ask him to read Exhibit 28, if he will, please?

A The following illustrative deliverability schedules are presented to indicate one of a number of alternative methods of supplying the requirements of the Alberta Natural Gas Company in the light of presently estimated reserves. The fields included have been selected with a view to minimizing the amount of steel used in the early period of operations, and withdrawals are limited to the requested amountof 80 billion cubic feet per year.

The schedules include three fields that have been under development since the hearings were recessed last autumn, namely, the Many Islands, Countess and Sunnynook Fields. Reserves for Many Islands are based on the estimate of S. E. Slipper,and for Countess and Sunnynook on the comprehensive report of DeGolyer and McNaughton. The reserves for Pincher Creek and the Princess-Patricia-

Steveville area have also been adjusted to conform to the DeGolyer and McNaughton report. The reserves for Jumping Pound, based on Hume's report, have not been changed. In each field a program of well completions has been adopted that should prove suitable to the producers in developing their reserves.

In connection with the tabulation below, I should state that the reserves shown for Many Islands of 462 billion cubic feet are taken from an earlier report, an earlier estimate of Mr.Slipper's, and that figure should be changed to 551 billion cubic feet. We have not changed the deliverability schedule in connection with that increase of some 90 or 89 billion cubic feet. The reserves of raw gas are shown in the second column, the value of the slope used in estimating the reserve in the first column, the net gas withdrawals contemplated during the 2-year period in the third column, and the number of wells that we estimate would be required in the fourth column. Is it necessary for me to read this Table?

Q I do not think so, Dr. Brokaw.

A

Field &Producing Horizon	Basic Data "n"	Raw Gas Reserves MMMcf	Net Gas Withdrawals During 20-Year Period MMMcf	Number of Wells
Countess-Bow Island Sand	0.85	231	74	35
Many Islands -Medicine Hat	0.72	462	141	75
Pincher Creek - Madison	0.685	2,300	1,126	24
Princess - Basal Alberta	0.85	192	61	30
Princess-Lower Cretaceous	0.685	156	47	20

Sunnynook - Viking	0.85	82.5	27	15
Sunnynook - Blairmore	0.85	99	27	15
Total		3,522.5	1,503	214

The above summary indicates how the fields mentioned could supply the gas needed for the pipe line for a period of twenty years. Moreover, when steel becomes readily available it will be possible to extend the Alberta Natural Gas Grid system to other areas of the Province, thereby widening the market available to producers. Should the Board deem it advisable to substitute or to add other fields or to alter the amounts taken from the fields, the general features of this projected gas supply would still apply if the changes were economically feasible.

PINCHER CREEK

In the preparation of this schedule we have departed somewhat from the tradition of limiting production to 25 per cent of the open flow potential. In a previous submission before this Board it was pointed out that this limitation is, at best, only an approximate rule of thumb, and that a more significant criterion of safe operation is the differential pressure existing at the sand face.

Consider the equation: (Taken from Exhibit J-12), and I do not think I will read the Table or the equation, I mean, but I can give the solution of that algebraic equation to arrive at the P_f-P_s. What that says, for a given value of "n", with 25% of the open flow, the differential pressure is a linear

function of the formation pressure.

$$\frac{Q}{AOF} = \left(\frac{P_f^2 - P_s^2}{P_f^2}\right)^n$$

Where:
Q = rate of withdrawal
AOF = absolute open flow potential
P_f = formation pressure
P_s = pressure at sand face
n = slope of the back pressure curve

Substituting 0.25 for Q/AOF and solving for $P_f - P_s$ we have:

$$P_f - P_s = P_f \left\{ 1 - \left(1 - (0.25)^{1/n}\right)^{\frac{1}{2}} \right\}$$

Accordingly, if production is limited to 25 per cent of the potential, the resulting differential pressure at the sand face is a direct function of the formation pressure P_f, which decreases as the reservoir is depleted. This results in a steadily increasing factor of safety; and if the 25 per cent limitation proves satisfactory under initial operating conditions, the restriction thus imposed would be unwarranted and could enforce uneconomical operation in the later stages of the field.

As an illustration of a method whereby these considerations could be taken into account, the deliverability schedule for the Pincher Creek field has been set up on the following basis:

(a) The 25 per cent limitation has been applied until about one-half of the recoverable reserves have been withdrawn, (i.e., about the beginning of the 14th year.)

(b) Thereafter, withdrawals have been continued at the rate permitted by the 25 per cent limitation at that point,(i.e., 165 MMcf net), until the differential pressure at the sand face reaches 75 per cent of that which existed under the 25 per cent limitation at the initial operating conditions, (i.e., 20th year).

In the case of Pincher Creek, this method of withdrawal is of particular economic significance since it will permit longer operation of the expensive gas treatment plant at or near full capacity.

JUMPING POUND.

A deliverability schedule for the Jumping Pound Field has been included in recognition of an existing purchase contract for gas, which was entered into in 1948 and still exists in modified form. Because it is realized that the field may be restricted to local use, this schedule has not been included in the summary but is set out separately. The amount shown as "possible available" is limited to production of pipe line gas in excess of 20,000 Mcf per day, which is presently under contract to Canadian Western Natural Gas Company Limited.

This schedule is based on the same estimate of reserves as the schedule previously submitted, but because of the results of back pressure tests made early in 1951, the slope of the curve has been changed to n = 1. These recent tests indicated considerable decline

in open flow potential from the earliest tests of two, of the wells, but these wells were not selectively acidized after recompleting and retubing, and we are informed that such treatment is contemplated with a view to restoring the higher potential indicated by the original tests. We have, however, reduced the estimated average well potential under initial conditions to 30,000 Mcf per well.

Then follow the schedules which are listed, and it seems hardly worth while to read these schedules.

MR. NOLAN: Nothing further, Mr.Chairman.

THE CHAIRMAN: Anybody like to question Dr. Brokaw?

MR. C. E. SMITH: I have one or two questions if no other counsel have any.

MR. STEER: I have a question or two, Mr. Chairman.

.....

CROSS-EXAMINATION BY MR. STEER:

Q On page 1, Dr. Brokaw, do the number of wells in the fourth column mean that those wells are being drilled additionally to the wells that are already there?

A That is the total.

Q That is the total number of wells for the particular field?

A That is my recollection. I think that is so. It is probably indicated in the tabulation. Yes, this was the total.

Q No further independent study has been made by you or your associates of these fields since the time of the Board's

Report?

A I do not quite understand what your question is?

Q You have made no further studies of the fields for the purpose of changing your views or estimating what there is in the way of new fields?

A No, not personally.

Q But your information here which differs from that which was before the Board on the Joint Hearing, comes from your adoption of the studies of other people, your opinion, that is correct?

A That is correct.

Q That is right?

A Yes, insofar as the reserves are concerned.

Q And you spoke of three fields which have been under development since the Hearings were recessed last August, last autumn, and I am referring to page 1, Many Islands, Countess and Sunnynook?

A Yes, sir.

Q And your figures with respect to those are taken from Mr. Slipper and Messrs. DeGolyer & McNaughton?

A That is correct.

Q You do not mention Cessford?

A Yes, sir.

Q I wonder if you would be able to tell me what fields have been discovered, what new fields have been discovered since the date of the Interim Report?

A I am not quite sure that I can. I think that that will probably be covered in the Report on the trend of Development, as we have covered some features of that.

Q Yes?

A A subsequent submission.

Q Which is to be given here?

A Yes.

Q By you or your associates?

A By myself.

Q I see. And you are not able to tell us what, in your view, are the new fields that have been discovered and what the reserves of those particular fields are?

A As I say, that has been discussed, and will be discussed in another place. I cannot offhand tell you that, no.

Q Will I find it in this second document?

A You may not find it exactly in respect to the question which you have posed. There is a real question as to what the date of discovery is, When you drill a well, you may have, of course, a gas well, and later you may have that developed into a field. Now, when is the field discovered? Is it discovered when the first well finds gas, or is it discovered when there is enough gas to justify an estimate of reserves? You see, that question is one in which there is a time lag which may be several years.

Q Quite so. All I wanted to know, Dr. Brokaw, was whether you were in a position to tell us what, in your view, is the volume of new reserves that have been discovered in the Province since the 1st of January of this year?

A I am not sure that I have that in this other report, and I have not made any tabulation on that.

(Go to page 968).

Q I say, you understand what I want. The Board makes a report, it is based on your evidence and on the evidence of other experts, it comes to a conclusion as of the 1st of January this year. Now, what I would like from somebody who is capable of telling it to me is how much gas has been discovered since the date of that report.

A Would you be good enough to give me your definition of "discovered" in view of the question which I posed a moment ago?

Q I will say new fields and extensions of old fields.

A I think that could be done. I do not think I prepared it in specifically that form.

Q Yes. You are, of course, quite familiar with the Hume Report?

A Yes, sir.

Q And I suppose you are familiar with Dr. Hume's treatment of the words "proven and probable"?

A Yes, sir.

Q And you are aware, or are you aware that he deals with Jumping Pound reserves as probable gas?

A I think he did, yes.

Q And where am I going to go to find out how your company proposes to deal specifically with the needs of Canadian Western?

A Mr. Dixon has covered that subject, I think, not specifically with Canadian Western but for the Province as a whole.

Q I see. Do I go back to Exhibit J-13 in the Joint Hearing?

A Is it J-13? I am not sure of the number.

MR. NOLAN: Yes, it is.

A Yes, sir.

Q MR. STEER: That is where I get it?

A Yes, sir.

Q You have told us, of course, that you are relying on Mr. Slipper and on DeGolyer and McNaughton for the greater part of these new reserves?

A That is correct.

Q And your table on page 1 is just as sound as that estimate of reserves is sound?

A As those estimates of reserves are sound.

Q Yes?

A Yes, sir.

CROSS-EXAMINATION BY MR. McDONALD:

Q Dr. Brokaw, with regard to the Jumping Pound field?

A Yes, sir.

Q We had evidence here the other day from Mr. Trostel in which he mentioned there was a wellhead initial pressure of 13,500 Mcf. for the average wells?

A 13,000?

Q - 500, yes.

MR. STEER: Mcf.

Q MR. McDONALD: Yes?

A That was a wellhead open flow. I do not know where he got that. The figures which were derived in the tests I list have had a range from, if I remember correctly, from 11,000 to 28 for the wells which were re-tested. I do not have those figures with me but they are in

the possession of the Board, I am quite sure. They showed an average slope of about .96 in the back pressure tests that were made, as near as I can give you.

Q You are quite confident or quite satisfied yourself to use the potential per well that you have used?

A Yes, particularly as I made no use of the production.

Q Because you do not make a 100 per cent use of the production?

A No. I did not take it into the summaries at all, Mr. McDonald. It is just there in recognition of the contract which is in existence, but that is not taken into the summaries.

Q Apart from that, you are --

A I think that is a fair estimate of what we may expect from Jumping Pound.

Q And then dealing again with Jumping Pound, Dr. Brokaw, you use a shrinkage factor of 20 per cent?

A I think so, yes.

Q That comes to pipeline at 80 per cent?

A Yes, that is right.

Q And you have also used 13 wells to develop the field?

A The only change in that was the slope, Mr. McDonald.

Q Now, sir, coming to Pincher Creek field, Dr. Brokaw. As you set out, you have used a slope of .685?

A Yes, sir.

Q And then you have used the open flow potential of 83 million feet per day?

A Yes, sir.

Q I would suggest that the .685 was the lowest figure that

you took from the tests made by the Gulf Company?

A As I recall it, Gulf had three tests showing very closely an average of .685. They had one test before acidization showing a slope of something over 1, and in making the estimates that Gulf made for the essential of that well they used a series of points. The computation is a desperate one because I have undertaken it several times and never worked it out. They drew a line out above .685 to make their estimate of the open flow capacity, I mean, the open flow potential. Now, if they had taken that point and followed the procedure that is suggested by the Texas Railroad Commission, drawing a line at .685 would have given a volume of that well of 150 million cubic feet, and if they had used 115 it would have been 470 million cubic feet. Now, whatever slope you used, it seems to me -- this is an arguable point, but it seems to me whatever slope you use in arriving at your well potential is a reasonable slope to use in arriving at your withdrawals until you have reason to know that it is wrong.

Q And then you used a raw gas reserve of 2300?

A 2 billion 300 million, yes. Excuse me, may I inject a word there?

Q Yes.

A That is DeGolyer and McNaughton's estimate of reserves in place, I mean, proven in place. None of the probable is included in that.

Q And that is comparable to the Board's interim report in which they used 1825?

A Not quite. That is reservoir gas, the Board's is raw high pressure separator gas.

Q Oh, I am thinking of the 1825 billion cubic feet.

A The 1825 submitted by the Gulf is high pressure separator gas and not reservoir fluid. I think I am correct in that.

Q Well, at page 20 in the interim report, estimated gas in place, billions of cubic feet, Pincher Creek, 1825?

A Yes, sir, but as I say, that there -- isn't that specifically the Gulf figure?

Q I believe it is very close to Gulf.

A I think it is the Gulf figure. If I am not much mistaken, that includes -- that figure at least in the Gulf schedules that I have seen they have discussed high pressure separator gas rather than reservoir fluid.

Q Yes. That is your understanding?

A That is my understanding of it, although I am not saying there would be that much difference if the proper correction were injected. I have not made it.

Q Now, just as a matter of interest, the Many Island field, as I understand it, the operating pressure, the initial pressure, is 551 pound, 598 pounds?

A I think we used 598. That was my own computation. Mr. Slipper, I think, has used 590 or somewhere in there but when you are working from surface pressures to bottom hole pressures that, I think, is not a serious discrepancy.

Q But the point I have in mind, that is one field in which you would have to have compression to put the gas in your

750 pound line?

A Yes, sir, because your deliveries would be more likely -- I mean to say, to get the delivery you want you probably would have deliveries much less than 600 pounds, nearly 600 pounds, that is correct.

Q And you have a slope there, an n slope of .72. Was that derived from tests?

A There were some tests which we used and that was as nearly as we could come. They were not made with the dead weight gauge but taking the best information we had that is our computation.

Q That is all, thank you.

CROSS-EXAMINATION BY MR. STEER:

Q I wonder if I might ask Dr. Brokaw one more question. When adopting DeGolyer and McNaughton's estimates I suppose you adopted their definition of proven and probable reserves?

A In that particular page, no. I just took their proved and eliminated their probable.

Q Let us look at Princess.

A Well, the Princess field is shown there. I mean, the Princess area includes several fields in DeGolyer and McNaughton. They have summarized them. Are you interested in one particular feature, Mr. Steer? I have some figures before me.

Q You perhaps have not this volume 3. I wonder if you would tell me, looking at this volume 3, census division 3, how many of the fields you include in the Princess field?

A I have it listed here in my notes.

Q Yes?

A Now, for the Basal Alberta we have taken the following reserves, what is specifically Princess, 138397; Rainy Hills 11596; Steveville North 12490; Steveville South 43089; Toronto 25064; making a total in detail of 191 billion, which we changed to 192 billion, which we rounded off to 192 billion.

Q Yes?

A The Basal Cretaceous --

Q Just a moment. The ones you have given me were taken, as I understand you to say, only from the proven column of DeGolyer and McNaughton's report?

A No, I said only so far as Pincher Creek is concerned, sir. I said that in response to Mr. McDonald's question regarding Pincher Creek. I said we had used only the proven reserves but in regard to the others we have used the same basis of proven and probable reserves in place.

Q Let us go through these. Countess-Bow Island you have got 231 billion. Now, I looked at this Exhibit 10, page 1, of census division 3, and see 135,217 as the total of proved and probably in Countess.

A That is in Exhibit 10?

Q Yes?

A In the previous exhibit the amount was 231 and that was used in these schedules. The other had not been delivered to us, we had no access to it. The changes in that and the changes in the Sunnynook field --

Q I want to find out whether or not what Dr. Brokaw is

talking about is what DeGolyer and McNaughton are talking about. You understand what I mean?

A Yes, I do. I may say we made a computation substituting new reserves in Sunnynook and in the Countess fields and found that the net effect of it, the over-all net effect of it was only a very, very minor thing in the 20th year of operation, simply because the two corrections of DeGolyer and McNaughton happened to be essentially compensating corrections.

Q Apart from Pincher Creek your quantities here include both the proved and probable reserves stated in Exhibit 10?

A That is correct, the proved and probable in place. You will notice, of course, in every case there is a substantial residue of unproduced gas at the end of the 20th year period which affords a cushion.

Q To push out the last gas required?

A No.

Q MR. C.E. SMITH: Dr. Brokaw, if I understood you correctly to Mr. Steer, your second column, I am referring to the table at the bottom of page 1, your second column is taken from Exhibit 4 or 4-A, that is volume 2, I suppose?

A Yes, that is volumes 1 and 2, I think.

Q To give you an example, of your 231 for Countess?

A That is correct.

Q Is in Exhibit 4, census division 3, page 9, as a matter of fact, but if you refer to Exhibit 10, which is volume 3, we find in that case they have decreased considerably. Do you remember that, Doctor?

A Yes, that is correct. We did not have access to 3 until a later time. We had to get these things ready and when volume 3 came in we re-cast the schedules but did not have an opportunity of course to have them offset, and the net effect is to my mind negligible. I have copies of the re-cast schedule which I will be glad to file with the Board, but I am not prepared to submit them as exhibits.

Q I think you will find in volume 3, that is, Exhibit 10, that the total you have of 231 has been changed by DeGolyer and McNaughton to 167 or something.

A I think that is probably true.

Q Doesn't it affect your total at all?

A It would change that total, yes.

Q With regard to your withdrawal wells?

A It would shift withdrawals away from the Countess field. It just happens, fortunately for us, that the increases at Sunnynook are such that the two changes are essentially compensatory.

Q In any event, this is true, with regard to your second column the source we go to is the first two columns of DeGolyer and McNaughton. Is that a fair way of putting it?

A That is correct, that is fair.

Q And with regard to Mr. McDonald mentioning this, with regard to your slope, your first column figure, Countess, is .85. Is that this usual figure you all use?

A That is just catch-all. That is our escape clause.

Q I have heard about it. It is a nice thing to have, I guess, but that is true with regard to all your .85's,

is that so?

A That is correct.

Q You have had no tests from which you could ascertain this slope yourself or else they are not satisfactory. That is a convenient method of getting around it, but that applies to all of these?

A That applies to all of these. We did not have a satisfactory basis and we made all the curves, we plotted all the material that we had satisfactory measurements for or even some of them which were questionably satisfactory just to make sure about it.

Q Then going to your last column, Countess, number of wells 35?

A Yes.

Q What consideration did you give to the question of spacing when you had 35 wells there? I will put it this way to you, Doctor, if my figures, and DeGolyer and McNaughton had proven probable 10,000, I understand, with all fields except Princess, you take all proven and probable into consideration?

A With the exception of Pincher Creek.

Q I wondered if you had any idea of your 640-acres per well and what consideration you gave there?

A I haven't it in my mind, sir. I do not know whether we limited it to 640.

Q Someone suggested to me that gets a well on each 640 acres in this particular field?

A It does?

Q Don't ask me, I can't use a slide rule or anything else.

I was wondering whether you had thought of that and whether you could help us in any respect?

A We reduced the number of wells in a re-computation. We reduced the number of wells in the Countess field to 25.

Q I did not get that. You reduced that?

A In this re-computation we reduced the number of wells in the Countess field to be drilled or completed out to 25.

Q Do I take it that we can amend this figure of 35 to 25?

A Excepting it won't tie with the schedule except this schedule I am prepared to file with the Board.

Q Have you any other amendments of this nature that you have in mind, Doctor?

A Yes, there is one from Sunnynook. I guess there was no change although we used increased reserves. We did not in this schedule here increase the number of wells in the Sunnynook Blairmore, which is the area of the reservoir in which the changes were made. This reduced the total wells to 204, but this, of course, is very definitely an illustrative schedule and one that we can adhere to rigidly.

Q Well, the only reason I asked that question is that when you mentioned the reduction of 35 to 25 I wondered if there was something else.

A I do not think there is anything more.

Q Going back to the question of your slope and your explanation where you used your .85. Supposing you had by test got a slope in 1 or possibly 2 wells, in your opinion should you use that throughout the field or would you prefer to use .85?

A. W. Brokaw,
Exam. by Mr. Smith.

A Well, if I had two or three weeks which showed reasonable consistence I would prefer to use an average of the tests that I had rather than rely on the .85, as I did in the case of Jumping Pound where the three tests that were made ranged -- I can not give you the exact figures but your own men can, I think, ranged from about .89 to just above 1. No, I guess it was higher than that. I took them as .97 and I said we might as well use 1.

Q I suppose then it depends on what you take, what the person who is calculating thought of the test?

A That is part of it. You see, there were three tests. There were tests on three separate wells, I should say, and that gives us a better idea of the slope of the curve than any individual well would give.

Q And if you have that kind of tests you then use that slope for the whole field, is that the idea?

A Until we have reason to change it. We know it is likely with further development and further tests we are likely to change it. It is also probable that during the life of the field the slope, the general for the whole field, deliverability characteristics, are not unlikely to have some change.

Q With regard to Pincher Creek, by the way, have you had available to you any submissions that Gulf may be putting in here?

A No, sir, I have not. I know that they are going to and I was hoping they would do it before I got here.

Q Before you left?

A No, before I got here.

Q Oh, yes. I think Mr. Trostel mentioned here the other day on the question of economics of drilling the well, used a figure of about 2 cents per Mcf. as sort of a rule-of-thumb idea. Were you here? Did you hear him?

A Yes.

Q I wonder if you would let me have your comments on that, Dr. Brokaw?

A It all depends on what you can get for the gas.

Q Well, that is what struck me.

A I have been told that some farm-outs are available in this Province whereby the developer pays 3 cents royalty or 15 per cent of royalty, whichever is higher. That means that not only have you got to develop it but have got to pay 3 cents for it after you get it. You see what I mean, Mr. Smith?

Q I see. I was wondering if you had any general comment that might apply to it, that is all, in your experience, Doctor?

A I do not believe I have a figure. If I gave one I might want to take it back.

Q I understand that. You would prefer not to do anything of that nature, is that right?

A That is right.

Q If you turn to page 2 -- oh, I think Mr. Dixon discussed that. Turn to page 3, would you mind, Doctor, in Jumping Pound you say,

> "Deliverability schedule for the Jumping Pound field has been included in recognition of an existing purchase contract for gas, which was

"entered into in 1948 and still exists in modified form."

Is that a contract that has been presented to the Board along with the application?

A Exhibit J-51.

Q I had forgotten if it was given a number.

A Exhibit J-51.

Q And I take it you are referring to --

A Oh, it has been filed with the Board.

Q Between Shell and Northwest?

A Between Shell and Northwest.

Q I wanted to make certain it was the one you had reference to. Then if you turn to the top of page 4, and I think we had better read the bottom of page 3, talking about Jumping Pound:

"This schedule is based on the same estimate of reserves as the schedule previously submitted, but because of the results of back pressure tests made early in 1951 the slope of the curve has been changed to n = 1."

A That is correct.

Q That is, I take it, what you discussed with Mr. McDonald a moment ago?

A Yes, sir.

Q And those tests, are they something that you had the opportunity of considering and studying, or have you taken Shell's?

A Oh, no. They gave me just a bit of it. They gave me enough so that we could make some computations.

A. W. Brokaw,
Exam. by Mr. Smith.

Q So that when you say the slope of the curve has been changed to n = 1, what I am trying to find out is how you arrived at that?

A I arrived at that n = 1 by studying the deliverability characteristics.

(Go to page 983)

Q And I think you said . . .

A I beg your pardon?

Q I think you said a moment ago that with, it was .9 something, that you arrived at that, wasn't it?

A No, I said it ranged up to, I am not clear in my mind as to the figures, it ranged to .97, the average was .97, and I thought that was probably a figure to use, a figure that was simpler to use.

Q All right. And then you continued to say this, "These recent tests indicated considerable decline in open flow potential from the earlier tests of two of the wells, but these wells were not selectively acidized after recompleting and retubing, and we are informed that such treatment is contemplated with a view to restoring the higher potential indicated by the original test."
I wonder if you would expand that a little for me, Doctor?

A Well, apparently the situation at Jumping Pound is one in which the mudding off of the reservoir has caused considerable difficulty, and they tried selective acidation thinking to get with acid the more highly porous and more highly permeable features or parts of the section, in order to loosen any of the mud that was adhering to the well.

Q Yes?

A And the plugging off the flow of gas, or restricting the flow of gas. I have never seen the operation of selective acidation. That is a matter that I just simply discussed conversationally. I assume, and was told, that that was contemplated; whether it will bring it back or not, I am not sure.

Q Well, that last remark of yours is one in which I was mostly interested?

A Yes, sir.

Q You cannot give us any very definite opinion as to what may happen?

A No, that is just a matter. . .

Q Of trying it out and finding it out?

A Yes. Well, the fact that the earlier wells did show a capacity of 35 million or more. . .

Q Yes?

A . . . some of them, that, at least, to me indicates that something must be different below, down in the hole, because there has not been initially nearly enough gas taken out to reduce the capacity to anything like that degree that was shown in the tests of the two older wells.

Q Yes? And I take it this mudding off is similar to what Mr.Dodge described to us earlier?

A Yes, that is exactly the same thing, except this is something whereby acid gives a little more effectiveness to it.

Q But he was talking about that too?

A Oh,yes, that is true.

Q Excuse me one moment, Dr. Brokaw, will you?

A Yes, sir.

Q Just along that line that I have been mentioning, Dr. Brokaw, in your opinion do you think the earlier tests in Jumping Pound show the greater slope?

A No. You may recall, sir, that, I think it was Mr. J. O. Lewis . . .

Q Yes?

Q . . . submitted, or in his testimony in connection with this slope matter, distributed, I do not think it was made an exhibit, but he distributed an exhibit which has been submitted to the Federal Power Commission on this matter of back pressure tests, and it has been, I understand, accepted by the Federal Power Commission categorically that any slope outside of the range of .52 to 1.0 is wrong. Now, the same thing is suggested, not quite so categorically, in Monograph 7, excepting in Monograph 7 I think the upper limit is 1.2. There is always a suspicion that you have some liquid which affects, or which causes an error in your bottom hole measurement, which is responsible for the low slope, excepting in very, very low pressure conditions.

Q That latter remark is Dr. Brokaw's opinion or consideration?

A That is correct.

Q I wanted to get yours rather than getting somebody else's?

A Well, I think that looks sound to me. There are some real questions that need yet to be answered.

Q Well, that statement that you made with regard to Mr. Lewis, if I remember correctly, that statement is in one of the submissions put in by Lewis?

A Yes.

Q That is all I have to ask about this, thank you, Dr. Brokaw.

.....

EXAMINATION BY DR. GOVIER:

Q Dr.Brokaw,I believe you were here when Mr.Dougherty gave his explanation of provable and probable concept?

A Yes, sir, I was, for part of the time but not all of it, that is right.

Q When he gave his ideas?

A For a part of it.

Q You may recall that Mr.Dougherty suggested that even though there were all gradations in the precision of the estimates, that he, nonetheless, felt it reasonable to add the proven and probable together to get a figure to compare with the Board's established?

A Yes.

Q And then later on Mr.Dougherty did suggest that if we wanted to confine ourselves to reserves as of today, it might be reasonable to apply a discount to the second group "probable". I would like to have your views on that whole subject, Dr.Brokaw?

A That is a tough one.

Q That is why we are asking it of you?

A It is unfortunate that there is such a diversity definition between proved, I mean, of usage - I do not think anyone defines it very sharply excepting Dr. Hume. Dr. Hume classed his proven reserves as those that are estimated by pressure decline, and his probable are those estimated by the volumetric method. It seems to me that the method of defining, of separating proven and probable, proven and probable reserves, I mean, depends very largely on the available information, and on the skill, experience and objectivity of the individual who makes the determination.

Essentially it comes down to a matter of judgment. I quite agree that there is a gradation, and particularly in the probable element of the reserves. It seems to me - I haven't tried to look at the thing from the standpoint of making any estimate of what a proper discount factor to apply to the probable is. About the only thing that I could suggest would be that the discount on the probable might be of about the same order of magnitude as the possible, and then cut the possible off. It is not anything that I think can be handled exactly or precisely.

Q If you were in the Board's position, Dr. Brokaw, what would you do in attempting to arrive at a single total which was to reflect gas now known that the Province could reasonably expect? Would you take proven plus probable, always remembering, of course, that we are confining our thoughts to what is now known?

A To what is now known?

Q Yes?

A If I may expand on that just a moment?

Q Yes?

A If we add the progen and probable together as a basis for studying deliverability, and leave a reasonable cushion in our deliverability schedules which might be defined, I suppose, as gas that still remained in the formation at the time that we thought our, that we had brought it down to a point where our deliveries were nominal or modest, it seems to me that that cushion affords a little leeway, I mean to say, in such a schedule as we have prepared here. In some cases we have taken off 40% of the estimated reserves, and 60% and even larger

amounts, but I suppose that if I were in your position I would have to reach for something, and I would not feel that carefully prepared estimates of probable reserves ought to be discounted more than 10 or 15%, I think, but that is only a matter of feeling. It is not based on any analysis of the situation, I mean, any detailed analysis.

Q Dr. Brokaw, I am very interested in the proposal concerning delivery rates which you advanced on pages 2 and 3. I wonder if, in the development of this concept, and in your study of it, have you given any thought to the possible impact of this method of operation on a field where the retrograde condensation might take place?

A I have not studied that. Of course, retrograde condensation can cause trouble faster than anything else. However, if you exhausted half of your reserves, or approximately half, I think you would be in the range of retrograde condensation. Of course, that is a specific character of fields.

Q Yes?

A I think you would get it probably earlier in Pincher Creek. That is simply because of the very large amount of the heavier fractions. I think you would probably get it earlier there than in almost any of the other fields.

Q Do you think that the retrograde condensation may have almost completed itself by the time the pressure dropped to half of its original?

A That is conceivable.

Q If that were the case, then it would not enter into the picture at all, I suppose?

A I suppose. I have not thought that thing through. But it

is a serious difficulty and an extremely difficult one, even with tests of the reservoir fluid. I think that so far as Pincher Creek is concerned, I think that the Gulf has made rather extensive studies in which they have attempted to reproduce the reservoir conditions in the laboratory. Those are not wholly satisfactory, because they have always the limitations of pressure and so on, and they have their troubles, but I think they probably could give you a much more and much sounder answer to that than I could.

As a matter of fact, I think there is only one thing that you can do to avoid retrograde condensation in a great many cases, and that involves this cycling, and it does not always work, because that, of course, depends upon the distribution of the permeability in the formation. I have seen cases where cycling started with about a minimum economic recovery of say, 15 or 16 barrels of condensate to a million cubic feet of gas, and within a relatively short period of time the injected gas, of course, sought out the more permeable parts of the reservoir and pretty soon they were really cycling, and the condensate recovery dropping to a point, well, they finally moved the compressors away from that particular job because they would not work.

Q The Board's understanding is that cycling is not probably economically justified at Pincher Creek, because the retrograde condensation represents a rather small loss?

A I think that is probably true, and there are mechanical difficulties, too, in re-injection, and then again if you do not clean the gas, you have all this embroilment and

all the other difficulties you get from high sulphur gas.

Q I was going to ask also something that you have just mentioned, Dr. Brokaw, and that is, have you discussed with the operators of the various fields this idea of, this new scheme of yours of production rates, for example, have you discussed it with Gulf, as to whether they would be agreeable to operating under this scheme?

A I gave Gulf a copy of this and I understand they do not object to it. I have not discussed it in detail with them.

Q Yes?

A As a matter of fact, none of the operators that I have discussed the matter with have objected to this, although perhaps some of them would not want to wait until 50% was gone. They might want to, perhaps, carry the initial differential down. That is like the case that Dr. Hetherington presented here in which he, I think, considered it after 5 years of development. This was arbitrary, sir, that is to say, going on until half, or essentially half of the recoverable had been recovered, that seemed to me to give an adequate period for knowing whether it made sense or not, and if it did not make sense, you would not go on with the project. I think, fundamentally, in the hands of skilful operators, control of the well by the man who knows its history, and knows how it acts, is probably better than any arbitrary amount that we can go on, unless he is avaricious and wanted to liquidate his assets too rapidly.

Q To what fields did you apply this proposed method?

A Just the Pincher Creek field. It did not help in any of the others, and we just let it go. It does help a great

deal in the Pincher Creek Field. That one seems to me particularly to be important on account of the requirement of relatively even deliveries to the various utilities and sulphur plants and so on. I think there are many fields where you can vary your deliverability, vary your delivery, and you will note, of course, by experience after operating an ordinary sand field, if not too high a pressure, you know how wells behave. Of course, the other feature of this departure from the 25%, which I have not studied carefully, but which I think is important, is the variability. It is variable in cases of short-term peaks, that is to say, where you have a peak that exists for a week or so. It seems to me it might be much simpler to handle it by a temporary relaxation there of the requirement, always provided you have an operator who is interested in maintaining the property.

Q Yoar schedules actually reflect that procedure, do they not?

A Oh, yes, sir. On the Pincher Creek Field it does.

Q And in the other cases too?

A No. I say it did not make any appreciable difference in the other cases, so that we did not put that into effect, although it could be done with great ease.

Q What I mean to say, let us take a field, say in the case of Countess, in Schedule "C"?

A Yes, sir.

Q Under the total "Raw Gas Production" you have a column headed "Average as per cent of Potential". I take it those figures are the percentage of absolute open flow?

A That is correct.

Q Well, then, in time when the peak-day exceeds the average, the per cent open flow on the peak-day will exceed the figure given in the column, will it not?

A That is correct.

Q I suppose it is possible that the first entry might exceed 25, but it does not look as if any of the others would, even in a peak day.

A I do not think they would.

Q I see. Thanks, Dr. Brokaw.

THE CHAIRMAN: We will adjourn for a few minutes.

(Hearing resumed after short adjournment).

MR.NOLAN: I assume, Mr.Chairman, that the Board has finished its questioning of Dr. Brokaw?

THE CHAIRMAH: Yes.

MR.NOLAN: And that other counsel have done the same, in which event I would like now to introduce the second of these submissions, which is entitled "Data on the Trend of Natural Gas Discoveries in the Province of Alberta", and I would ask if the Board would give it Number 29, if you will, please?

THE CHAIRMAN: Exhibit 29.

DATA ON THE TREND OF NATURAL GAS DISCOVERIES IN THE PROVINCE OF ALBERTA SUBMITTED BY NORTHWEST NATURAL GAS COMPANY, MARKED EXHIBIT 29.

Q MR.NOLAN: Have you that before you, Dr. Brokaw?

A I have.

DIRECT EXAMINATION BY MR.NOLAN:

Q Will you please proceed to read it?

A Yes, sir.

TREND OF GAS DEVELOPMENT

In the Interim Report of the Board dated January 20, 1951, the statement is made that, "...if as a result of more intensive exploration and the establishment of further gas reserves, a successful trend is indicated, the Board would be prepared to consider recommending the granting of an export permit based upon a lesser degree of provincial protection."

The history of natural gas development in Alberta has been outlined in the report of the Dinning Commission, as well as in other official and unofficial reports, and need not be reviewed in detail here.

Early endeavours were largely to obtain gas for local consumption and after the completion of pipe lines, to supply the accessible markets in the Province. During this period gas was discovered in a number of localities in connection with the search for oil, but unless a local market was available, wells were commonly abandoned to recover the casing which could be used in further exploratory tests. For many years the Turner Valley and Viking Fields, with accessory supplies from Bow Island and Foremost, were relied upon for the general supply, with the isolated Medicine Hat Field taking care of the requirements of that area.

Stimulated by the decline in oil production in the Turner Valley Field and the growth of

markets for petroleum products, exploration for oil found added impetus, but incidental discoveries of gas were more common than successful oil wells.

As a result of the discouraging outlook for local sources of oil and real progress in the development of processes for making liquid hydrocarbons from natural gas, a new phase which was introduced stimulated the search for gas.

In an effort to obtain reserves for a synthesis plant, Imperial Oil Limited began an active campaign of exploration and development in 1945. This resulted in establishing large reserves in the Kinsella Field and in the discovery of the Provost Field. The following year the McColl-Frontenac-Union group undertook a similar pronect in the Pakowki Lake area, leading to the discovery of the Pendent d'Oreille, Manyberries, Smith Coulee and Black Butte Fields.

The discovery and development of the Leduc and Redwater Fields led to the abandonment of these projects for synthesizing liquid fuels from natural gas, but it should be noted that two systematic and sustained efforts to establish large gas reserves were successful, although they were pressed for only two or three years.

With the greatly accelerated exploration for oil, many wildcat wells have been drilled, commonly finding gas more frequently than oil. But efforts to establish gas reserves as such were discouraged owing to the lack of markets. More recently, stimulated by

the anticipation of possible permission to export gas, some systematic efforts to establish reserves have met with measurable success and promise of substantial development.

The trend of gas discoveries was discussed at some length in the report of the Dinning Commission, and while strictly comparable statistical data were lacking, a general trend was indicated, which was supplemented by testimony of various expert witnesses.

Quoting from the U.S.Federal Power Commission, the Dinning Commission suggests that the future may be judged from three viewpoints, namely:

(1) "Past performance regarding additions to known reserves and the industry's record in meeting requirements."

(2) "Analysis of statistical data bearing on the rate of discovery of new gas and the results of drilling operations including wild cats drilled and the number of dry holes."

(3) "Consideration of the areas believed to be favourable for the finding of oil and gas, and of the extent to which such areas have already been explored."

The interval between the recess of the hearings on which the Interim Report was based and the present is too short to afford a firm basis for satis-

factory statistical analysis and trend forecast, but it is of interest to review the situation over the past in order to appraise the trend already existing, as well as to note the changes since the Joint Hearings were recessed.

1. Growth of Reserves

While direct comparisons of a series of estimates of gas reserves over a considerable period of time are difficult, largely because of the diversity of estimates and the impossibility of reconciling them to form an adequate basis for a statistical study, the general increase in reserves is clearly evident. The three exhibits on reserves submitted on behalf of this applicant, namely, Dr. T. A. Link's before the Dinning Commission, Mr. S. E. Slipper's, based on estimated reserves by geological horizons, and Mr. A. Faison Dixon's, based on a consensus of various reports, are on widely different bases and are not susceptible to statistical comparison.

There are available, however, three estimates of the reserves of the Province prepared by Hume and Ignatieff. The first of these, released in April, 1948, indicated "Proven and Probable" reserves of 3,618 billion cubic feet. In the hearings before the Dinning Commission in November, 1948, a supplementary report revised these upward to 4,282 billion cubic feet, and in July, 1950, a new report was issued bringing the total to 6,365 billion cubic feet. Whether or not one accepts the validity of these figures, they may be

compared on a date scale because they have been prepared on the same basis, (e.g., 100 p.s.i.a. abandonment), by the same individuals using the same methods of approach, and the relative figures afford an indication of the trend over the period involved.

The same may be said of the estimates of Dr. A. W. Nauss, which were supplemented from time to time to take account of new developments. The first, dated January, 1950, gave recoverable reserves of 6,117 billion cubic feet. This was supplemented in May, 1950, increasing the figure to 6,246 billion cubic feet; again in November, 1950, bringing the total to 6,548 billion cubic feet, and finally in August, 1951, indicating 7,811 billion cubic feet.

The trends are shown on the chart opposite. It will be seen that the Hume and Ignatieff estimates indicate an annual rate of increase of 1.2 trillion cubic feet and those of Dr. Nauss 1.1 trillion cubic feet. The slopes of these graphs are in good agreement and indicate an average increase of about 1.15 trillion cubic feet per year over the period covered.

(Go to page 998)

Q Dr. Brokaw, those little clusters of arrows represent what?

A Those are the applied points.

Q Those are the time at which those estimates were made?

A Yes, four on the Nauss marketable curve and three on the Hume Ignatieff to 100 pounds.

During the same period Provincial production averaged approximately 68 billion cubic feet per annum, of which some 16 billion cubic feet was classified as waste. On this basis reserves have been increasing at eighteen times the average rate of withdrawal. While there may well be some variance between this figure and those estimated by others, it is evident that the production branch of the petroleum industry is adding to known reserves at a rate far in excess of current requirements, and we may safely conclude that criterion (I) is amply satisfied.

II Results of Wildcat Drilling.

Since intensified wildcatting commenced only after the discovery of Leduc, evaluation of the progress in delineating new gas reserves should be limited to consideration of discoveries made since that date. Information on this aspect of the trend in natural gas discovery can be summarized conveniently from the report of DeGolyer and MacNaughton, in which reserve estimates have been brought down to August 1, 1951. While no representation is made as to the validity of these estimates, it is felt that they may be justifiably used to point out a trend since the bases of compilation are

comparable.

Taking 1948 as the beginning of the period, we obtained a statistical base of approximately three and one-half years. The pertinent estimates tabulated below have been limited to those fields appearing, at present, to be economically attractive to either of the two principal local utilities or an export pipe line, (i.e., fields with estimated available reserves in excess of 50 billion cubic feet).

Do you wish me to read the list?

THE CHAIRMAN: No.

THE WITNESS:

Field	Date of Discovery	Region	Estimated Proven & Probable Reserves in Place MMcf	Estimated Available for Sale MMcf
Acheson (1)	1950	Central	68,477	51,286
Boyle-Mustang-Amisk Lake,	1949	Northern	98,563	68,181
Brooks, North-east (2)	1948	Southern	102,112	80,473
Castor	1949	Central	142,766	110,933
Cessford	1950	Southern	290,011	225,264
Countess	1950	Southern	167,345	125,388
Cremona	1951	Central	90,250	68,830
Many Islands (3)	1951	Southern	462,000	346,500
Pincher Creek	1948	Southern	2,574,424	1,543,310
Sunnynook	1949	Southern	252,387	197,871
Whitelaw,	1950	Northern	708,875	556,721
Total -			4,957,210	3,374,757

Note: (1) Limited to non-associated gas horizons.
(2) Upper Cretaceous sands.
(3) Estimate of S.E. Slipper covering reserves of Many Islands. 'Available for Sale' has been assumed at 75%.

The map opposite shows, in addition to the above, other discoveries during the same period, with estimated net available reserves in excess of 10 billion cubic feet.

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From the standpoint of availability, the geographic location of these new reserves is of particular interest.

Then we tabulated, dividing the Province into three zones, you might say, Townships 1 to 30, Townships 31 to 60, Townships 61 and above.

Region		Available for Sale MMcf	%
Southern	Twps. 1-30	2,518,806	74.6
Central	Twps. 61-60	231,049	6.9
Northern	Twps. 61 & above	624,902	18.5
	Total -	3,374,757	100.0%

Interpretation of these statistics brings to light two important features in the development of new gas reserves:

(i) Despite the fact that wildcat drilling has been directed primarily to the search for oil and that little incentive to follow up gas strikes has existed, important additions have been added to the reserves of the Province.

(ii) The southern section of Alberta has proven to be by far the most fruitful.

Another aspect of the results of wildcat drilling affords an indication of the progress in new discoveries, namely, the trend in the number of completions of potential gas wells. The results of such tests indicate a trend in the frequency of discoveries, but in most cases adequate data for determining the extent of the field must await further development,

which, in turn, is deferred pending a market outlet.

That is, charts were placed opposite the page for convenience of the users.

The adjacent chart covering the period from January 1, 1950, to August 27, 1951, shows by months and cumulatively the number of wildcat wells completed and suspended as potential gas wells. The cumulative curve indicates an accelerating rate in the last few months. (It should be noted that this does not include wells that showed promise of commercial gas production but were abandoned.)

There it is necessary to make a couple of corrections, or three or four corrections in the chart. In the first place, November 1951, Shaw-Chapman 3 and Lloydminster field was classified as a potential gas well. In checking it up it should have been not included. It has been eliminated to conform with the Board's classification. That is, in our summary it has been. And in July 1951 we should have 7 wells instead of 6 shown, the 6 wells obtained from the Board's weekly report. Subsequent publication of the July Monthly Report showed 7. There is some confusion due to the variation in statement of completion dates. For instance, the Ajax Morinville No. 1 is shown as completed in July on the monthly report, also shown as completed in the week ending August 20th. It is completely understandable, it is a matter of explanation of our difficulties in arriving at the final figures. Other corrections have practically the same base but there are additional depletions since

this was printed and should be taken into consideration in the summary on page 7.

On the basis of reports of The Petroleum and Natural Gas Conservation Board, the record of wildcat completions since January 1, 1950, is as follows.

I will read those corrected figures. The first line, 1950, is correct, 1950, 34 oil wells, 1 gas well, 20 potential gas wells, 179 abandoned, total 234. 1951, not to September 17th instead of to August 27th, oil wells 35, gas wells 6, potential gas wells 50, abandoned 175, a total of 266, or the total for the period from January 1st, 1950, to September 17th, 1951, 69 oil wells, 7 gas wells, 70 potential gas wells, 354 abandoned, out of a total of 500. I may say that these 7 wells which were reported as wildcat gas wells completed we eliminated from the development of the curve. I think at least 5 or 6 of them were in the National Defence Program of wells down there. They were thrown into the tabulation as wildcats but we hardly considered them so because they are drilled right next door to other wells.

Exploratory and development drilling are said to have reached an all-time record during August, and considering the rate at which new reservations and leases are being taken and the great activity in geophysical surveying, there appears to be no sign of relaxation of effort along these lines.

The facts set forth in this section indicate clearly that the second criterion noted is being satisfied.

A. W. Brokaw,
Dir. Ex. by Mr. Nolan.

III Prospective Extension of Development.

The third suggested viewpoint, namely, the areal approach in an attempt to appraise future possibilities from knowledge of prospective areas of exploration and development, must, of necessity, be qualitative rather than quantitative, although some efforts to forecast the order of magnitude of probable discoveries have been made.

Long before the science of geology was applied to the exploration and development for oil, areal trends greatly influenced wildcat operations in the search for new fields. In fact, the anticlinal theory grew out of an attempt to correlate the location of fields and trends with geologic structure.

More recently, with refined techniques, both structural and buried shore line trends have been followed intensively, especially in carrying out preliminary geophysical surveys. For example, the "Conroe Trend" was followed from the discovery area eastward into Louisiana and far to the west, roughly parallel to the Gulf Coast. Many similar campaigns of "trend plays" could be cited, such as fault zones, the flanks of structural basins and buried reefs, and no small part of the development in many regions has been influenced by similar areal studies.

A considerable volume of testimony before the Dinning Commission took this form, and a large number of oil and gas fields and prospects have been found in some of the regions suggested, such as the area northwest

of Edmonton, the trend from Medicine Hat toward Hanna and Stettler, and the Peace River-Pouce Coupe district. Others, such as the Foothills Trend and the area along the International Border, have shown little activity, although at present interest in these areas appears to be reviving.

Among interesting recent completions, two may be mentioned as giving real promise of substantial development. In the Submission of the Hudson Bay Oil and Gas Company the following statement appears regarding the Bailey-Olds well:

> "It is quite probable that the D-2 has excellent possibilities over much of the Olds area. Bailey-Olds No. 1 is perforated in the Devonian D-3 and has demonstrated that it is a gas distillate well of major proportions."

From the data that was submitted on the Bailey-Olds well we made rather a quick estimate of the absolute open flow potential. It is 35 million feet. That would be, of course, subject to correction. I think that is the order of magnitude of the well.

Another well, the Shell Mackid, near Okotoks also shows promise. Preliminary tests showed high hydrogen sulphide content and excessive hydrate formation, and special equipment is required before final testing. Meanwhile, the company has begun drilling another well in the same section.

Since the discovery of Leduc most of the activity has been in search of Devonian reefs, but it

is anticipated that when these prospective areas have been largely tested attention will again turn to the Foothills Trend. The areas still to be explored and tested are very great, and if the door to a market for the gas is not closed the prospect for continued exploration activity at something like the present rate for many years appears to be assured.

Q Dr. Brokaw, on page 7 you set out some statistics showing the record of wildcats completion from the 1st of January 1950 to the 17th of September last. Are there any conclusions to be drawn from these statistics, Dr. Brokaw, conclusions of a general nature?

A In the first place, there was increased wildcatting activity in 1951 as compared to 1950. During the first eight months of 1951 more wildcat wells were drilled than in the whole of 1950, and there was a rapid increase of potential gas wells during the year. The ratio of potential gas wells to wildcats completed in 1950 is 1 to 11.7, in 1951 it was 1 to 5.3. For the same period the ratio of wildcat completions to successful oil wells in 1950 was 1 to 6.9; 1951, 1 to 7.6. So that the frequence of completion of potential gas wells shows in terms of wildcats a very great increase and oil shows a very slight decrease. I think probably the increase of potential gas wells is not only due to the incidental discoveries in connection with the exploration for oil, I think that encouragement to gas exploration has been given by the Board in the change of the regulations of the amounts of acreage that may be held for gas as

compared to oil. I am not too familiar with that in detail. And there is unquestionably development, as we all know, in anticipation of the issuance of a permit for the export of gas. So that the thing is perhaps not entirely a matter -- well, it is not entirely a matter of relative frequency of gas discovery incidental to oil. There is some definite effort to develop gas.

Q Thank you, Dr. Brokaw.

THE CHAIRMAN: Does anyone else wish to question Dr. Brokaw?

CROSS-EXAMINATION BY MR. STEER:

Q Do I go to page 5 of Exhibit 29 to get an answer to a question I asked a little while ago?

A It may not answer your question precisely, sir, but it is evidence as nearly as I can come to it.

Q And what volumes of gas would you say from that table on page 5 have been discovered since the date of the Board's report?

A From that table, 400 billion cubic feet, but that is limited to fields of more than 50 billion reserves.

Q I see. And you can not help me in finding out what the reserves under 50 billion feet would be?

A I could.

Q Where would I go to get it?

A You can get it out of the DeGolyer and MacNaughton report, I think. I made a tabulation of that. It was not exhaustive, but as I remember it, they showed that for fields for which they did not have sufficient data

for estimates in the earlier section and for which, due to development the data were now available, they added up 250 billion cubic feet net. For fields that were estimated in the earlier reports and revised in the light of developments in the interval, they added something on the order of 400 billion cubic feet. I have not those figures accurately, Mr. Steer, but I just summarized them now. That does not count the mathematical errors that are there. I am just taking the fields for which they made additions and subtractions and adjustments.

Q I think that is all.

EXAMINATION BY MR. C.E. SMITH:

Q Dr. Brokaw, I have just one question. Referring to page 5, and in the paragraph headed "Results of Wildcat Drilling", you say:

"Information on this aspect of the trend in natural gas discovery can be summarized conveniently from the report of DeGolyer and MacNaughton, in which reserve estimates have been brought down to August 1, 1951."

A Yes, sir.

Q "While no representation is made as to the validity of these estimates, it is felt....."

What are we to gather from that language,

"While no representation is made as to the validity of these estimates....." ?

A Perhaps that is an unfortunate phrase, Mr. Smith.

Q I am not criticizing it that way. I would like to get your opinion about it.

A Well, I think they are very good for these estimates but what I meant to say in a matter of a study of trends, in my idea, at least, of the study of trends, we need figures that may not necessarily be absolutely correct so far as they are entirely comparable in their source, if you see what I mean.

Q I gather you, yes.

A It is like running a level survey, you can refer to sea level or 4,000 feet above sea level, but the slope is the same.

Q What I was concerned about when I read that, I got the opinion, probably incorrectly, that you probably did not agree very well with it.

A Well, I had demonstrated the fact by using the figures elsewhere that that was intended more to say that even if you did not agree that they have this contribution to make to the study of the trend. That is what that meant.

Q We are not to assume Dr. Brokaw disagrees with DeGolyer and MacNaughton, is that fair?

A I think that is all right.

EXAMINATION BY DR. GOVIER:

Q Dr. Brokaw, are you able to indicate any comparison with trends elsewhere? I am thinking particularly of the trend in a number of potential gas wells which you have indicated on page 10.

A I do not think I have made a study on potential gas well trends in any other case, largely because the shutting-in of potential gas wells is pretty much a local phenomena. It happens, of course, but in many areas I believe there are some, that is true, but I have never made a trend study of it. I did it here because without the incentive for follow-up drilling it seemed to me that it did contribute something to form a basis for anticipation rather than to use as anything rigidly, and I certain did not extend this beyond the latest date of available information but it is a range shot, points in a direction rather than something that can be used quantitatively.

Q And at the bottom of page 7 you say that the early approach must of necessity be qualitative rather than quantitative although some efforts to forecast the order of magnitude of probable discoveries have been made. Were you referring to any numerical estimates you had made?

A Not mine. It was other people's. Before the Dinning Commission there were a number of figures put in but I preferred to keep it on a qualitative rather than on a quantitative basis.

Q Thank you.

EXAMINATION BY MR. C.E. SMITH:

Q Just one other question, Doctor. In the picture presented here, and with respect to what you call southern and northern, if I may use that term.

A Which page is that?

Q I am just speaking generally. And if I understand it, the southern aspect is much more promising than the northern, that is correct?

A Well, the discoveries have been much greater but the answer to that is Pincher Creek.

Q That is because you start after Leduc?

A That is right.

Q I mean, if we started back a little further and got Leduc in there it might not be the same?

A That is true. We have not put Leduc in there. It seemed to me that the trend we were most interested in was the trend since the spur to wildcat search for oil that followed Leduc.

Q As a result of Leduc?

A Yes. This is a by-product for the most part, I think, of the oil exploration.

CROSS-EXAMINATION BY MR. STEER:

Q Dr. Brokaw, will you tell us what you mean by potential gas wells?

A I used the Board's terminology. They put in their weekly reports and monthly reports shut-in as potential gas well and that is the answer because we come to the Board now to find out what this meant for this period of 1951 and it is in secret files and they can not release it to us.

Q This is information taken from the Board's reports?

A Yes.

Q And it is the meaning that the Board gives?

A Yes.

Q DR. GOVIER: It is to be from probable or possible?

A They are all possible.

THE CHAIRMAN: Mr. Macleod, are you ready to go ahead?

MR. MACLEOD: Yes, sir.

(Go to page 1012)

HUGH HAMILTON BEACH, having been first duly sworn, examined by Mr. Macleod, testified as follows:

MR.MACLEOD: Mr.Chairman, Dr. Beach, I presume, has been sufficiently qualified on the former hearings?

THE CHAIRMAN: Yes.

MR.MACLEOD: I will tender this brief of Dr. Beach's as Exhibit 30, is it?

THE CHAIRMAN: Exhibit 30.

BRIEF PRESENTED BY DR. BEACH
MARKED EXHIBIT 30.

Q MR.MACLEOD: Dr. Beach, will you be good enough to read the submission which you have prepared?

A The following further submission is made to your Board in support of the above-mentioned application. In addition it is our desire to acquaint your Board with certain recent discoveries of natural gas in the Province which have been made by Texaco Exploration Company.

PAKOWKI LAKE REGION

Since the presentation of our last submission to the Board on December 4th, 1950, McColl-Frontenac Oil Company Limited and Union Oil Company of California have drilled four wells in the Pakowki Lake region. One well, McColl-Union 7C-23-1-7 located in Lsd. 7 of Sec. 23, Tp. 1, R.7, W.4th, some six miles east of Black Butte, failed to obtain commercial production in the objective Bow Island Sand Series and was abandoned. Three wells were drilled during 1951 to the north of the

Manyberries gas field.

They are: McColl-Union 7C-4-7-6 located in Lsd. 7 of Sec. 4, Tp. 7, R.6, W.4th.

McColl-Union 6D-32-5-5 located in Lsd.6 of Sec.32, Tp.5, R.5, W4th.

McColl-Union 6D-14-6-6 located in Lsd.6 of Sec.14, Tp.6, R.6, W.4th.

The first two wells were abandoned after failing to find gas in commercial quantities in the Bow Island Sands. The third well gave no encouraging results in drill stem testing of the Bow Island Sands but the electrolog indicated thinsands that might possibly be gas-bearing. Inasmuch as the tests gave no formation water, it was decided to run casing through the sand zone. The casing was run and cemented b t not perforated and the potentialities of the well remain unknown.

Thus, none of the wells has discovered new reserves of gas or contributed data necessitating changes in any reserves figures presented in our submission of December 4th, 1950, respecting Black Butte and Manyberries gas fields.

OTHER AREAS

The following information respecting other fields has been acquired by me in connection with the operations of Texaco Exploration Company.

Majeau Lake Area

In July, 1951, Texaco made a wet gas discovery in dolomite strata of Mississippian age in its Texaco-Majeau Lake No. B2 well located in Lsd. 3

of Sec. 25, Tp. 56, R.4, W.5th Meridian. The indicated pay thickness is 89 feet. The open flow potential of the well in this pay zone was determined to be 9.5 to 10 MMcf of gas per day and 24 barrels per day of 60° plus or minus API distillate against a back pressure of 450 lbs. psig. A gas/oil ratio of approximately 98,000 cubic feet per barrel was thus indicated.

A second well, Texaco Glenevis, No. A-1, drilled in August 1951 to a total depth of 5618 feet in Lsd.7 of Sec.35, Tp.55, R.4, W.5th, obtained black oil production (18.3° API) in a 64-foot pay zone in what is apparently the same stratigraphical horizon as the productive zone at Texaco Majeau Lake No. B2. In addition, the Glenevis well found dry gas in a 49-foot pay zone in the McMurray sands of Lower Cretaceous age and also in a 31-foot sand pay in the Viking sands of basal Upper Cretaceous age.

The very close correlation that was found to exist between the structural data provided in the drilling of the two wells and the structural maps prepared in the course of detailed exploration before drilling leads us to the conclusion that estimates of reserves given below are of a much higher order of reliability than would normally be assigned to an area known only from two weeks four and one-half miles apart. Nevertheless, in the interests of reliability we have distinguished between proven and probable reserves. A third well, Texaco Majeau Lake No. C1 is shortly to be located to the north of Texaco Majeau Lake No. B2, and if it confirms our expectations substantially greater figures for both

proven and probable reserves might be justified.

Our present estimate of the natural gas reserves in Majeau Lake area are:

Well	Pay Zone	Pay Thickness (Feet)	Productive Area (Acres)	Proved Reserves In Place (MMCF)	Probable Reserves In Place (MMCF)
Glenevis A1					
	Viking Sd.	31	249	1,072	
	McMurray	49	553	7,270	
Majeau B2					
	Mississippian	89	1,097	15,225	82,625
				23,567	82,625

Total Proven and Probable Reserves = 106,192 MMCF.

Wizard Lake Area.

During April and May, 1951, Texaco Exploration Company drilled Texaco Wizard Lake No. B1, located in Lsd. 12 of Sec. 22, Tp. 48, R. 27, W.4th, to a depth of 5,984 feet and discovered gas in the Viking sand series, and oil in the Lower Cretaceous McMurray sands, the D2 (Nisku) and D3 (Leduc) members of the Devonian. Only the gas occurring in the Viking and McMurray sands is presently regarded as of commercial importance.

The areal extent of the Viking and McMurray pay zones were enlarged through the drilling of subsequent step-outs. They are Texaco Wizard Lake B2 (Lsd. 5 of Sec. 22, Tp. 48, R.27, W.4th), Texaco Wizard Lake B3 (Lsd.11 of Sec. 22, Tp. 48, R. 27, W.4th), and Texaco Wizard Lake B6 (Lsd. 10 of Sec. 22, Tp.48, R.27, W. 4th).

Dr. H. H. Beach,
Dir. Ex. by Mr. Macleod

The reserves established are regarded as proven and are:

Pay Zone	Max. Pay Thickness (Feet)	Area (Acres)	Proved Reserves In Place (MMCF)
Viking	26	381	2,596
McMurray	46	588	3,926
Total Indicated Proven Reserves to Date			6,522

Peace River Region of Alberta.

During the summer months of 1951 Hudson's Bay Oil and Gas Company drilled Hudson's Bay-Union Texaco No. 1 well in Lsd. 16 of Sec. 29, Tp.80, R.6, W. 6th Meridian on lands farmed out by Texaco to Hudson's Bay and Union Oil Company of California. The well was carried to a total depth of 5660 feet and discovered very substantial flows of gas in the Peace River Sandstones and in the Gething formation, both of Lower Cretaceous age. The well has been capped as a potential gas well because of the lack of a market for the gas. We shall not comment further upon this discovery inasmuch as details regarding the well have been embodied in a report prepared by Hudson's Bay Oil and Gas Company which, we understand, has been submitted to the Board during these hearings.

Q I understand that the report has not yet been submitted?

THE CHAIRMAN: No, but I understand it will be.

MR.MACLEOD: It has been distributed.

Q All right, Dr. Beach?

A In the course of our explorations in the vicinity of this well Texaco has delineated other large structures. Detailed

field investigations are now being carried on in attempts to find the most desirable locations for testing these structures by drilling. We regard the prospects of finding substantial reserves of gas on these indicated structures particularly encouraging considering that some four potential pay zones can be expected in the stratigraphic section in this region. The location of the region between two areas where commercial gas has already been found also augurs well for gas development.

At the present time, Texaco holds under Crown reservation or lease the mineral rights on some 1,057,289 acres of land in Peace River region and has expended to date just over one million dollars in the geological and geophysical surveys of these holdings. In the event of a market for gas being developed in this region, I believe that it would be the policy of Texaco Exploration Company to proceed with a substantial program of exploratory and development drilling.

Q That is all I have.

THE CHAIRMAN: Anyone any questions?

MR. McDONALD: I have some questions, Mr. Chairman.

.....

CROSS-EXAMINATION BY MR. McDONALD:

Q Dr. Beach, if you will refer to the Majeau Lake area on page 2 of Exhibit 30, as I understand it, you find in that area the Viking sand, the McMurray sand and the Mississippian?

A Yes, sir.

Q Now, the Mississippian is also known as the Madison lime-

stone.

A That is a loose term that is widely used.

Q Yes?

A We specifically used the Mississippian, because we just wonder whether the term "Rundle" is even a more precise term than that we use with regard to the Madison in this country, and that can be applied in this area. We know it is in there, but we do not know what to name it. We call it the Mississippian, but it is the Upper Kinderhook in age, and is akin to the Lower Mississippian.

Q This is a somewhat similar series to the one found at Pincher Creek and the Jumping Pound?

A It is probably all from the same series of rocks, but it has the same series of rocks as Turner Valley, Pincher Creek and Jumping Pound.

Q And this is a wet gas from the Mississippian?

A Yes, this is a wet gas from the Mississippian.

Q So that there would be production of distillate along with the gas?

A Yes, it would be expected.

Q Have you any idea of the hydrogen and sulphide content of that, if any?

A It is low. We have asked for an analysis, and I have not seen the analysis. Our engineering department has the analysis, and I could not get it for this morning.

Q Yes. You have indicated that you are carrying on further drilling in the area?

A Yes.

Q And on the basis of one well you established proved reserves of 23 billion cubic feet and then for the probable, you

have added additional acreage for the probable?

A Yes.

Q Now, will your subsequent wells establish greater acreage? I mean, are you contemplating that there will be additional acreage by the drilling of this other well?

A If it is productive, as we hope it will be, and I do not say that we hope, but if it is not a productive well, it is going to require some very radical change in our whole interpretation of that region. We believe it has a high probability of being productive and it is being located as a specific test of our present ideas with regard to the extent of these gas reservoirs, and it will also contribute more acreage than we have taken in in our present study of reserves in this area, if it is proved.

Q And it could extend your estimates from 100 billion roughly to several hundred billion, or would you care to venture an opinion?

MR. C. E. SMITH: You could move probable into proved, is that what you mean, Mr. McDonald?

MR. McDONALD: Yes, the probable into proved.

A I do not think I would like to make a comment as to what it might do?

Q Yes?

A But it certainly would advance it considerably above the 100 billion that we have indicated here.

Q Dealing with the Peace River region next, Dr. Beach, we have had this region referred to by other geologists as the happy hunting ground for gas. Now, I take it that you have somewhat the same idea that there is a good

prospect for gas discoveries in the Peace River region as a whole?

A Yes, sir. We regard it as an excellent country for hunting for gas. Our belief is backed up by the magnitude of our exploration in that region, the amount of money that we have spent and the intensity of our exploration.

Q Can you tell the Board more about how you arrive at your conclusion here, something of a detailed field investigation?

A Yes, sir. I have brought a map along with me. May I hang this map up?

THE CHAIRMAN: Yes.

Q MR. McDONALD: If you will put it on the other Board, Dr. Beach?

A Yes. While I do not profess detailed knowledge of every well that has been drilled in this area by any means, I am charged with the regional thinking and the policy with regard to it respecting our operations. On this map has been indicated the extent of our present holdings, These are all the reservations up here we hold at this time, and these areas which were previously in reservation form we have not got leases. On this map we have indicated the areas where gas has been found, the horizons from which the gas is being produced, and the indicated potentials on the data that has been made available to us.

Now, the basis of analysis could be approached from a variety of ways, but we think it is overwhelmingly a gas area and can be visualized in this way: If you take a typical area, for example, perhaps using

2° in width in longitude and 3° in latitude, an area of approximately 16,000 square miles, within that area they have drilled some 58 wells and 10 are currently drilling. In other words, they have not computed by this means all of the knowledge of what lies beneath that area. Of those 58 wells, some 21 have found gas in 10 distinct areas. In 7 of these the discoveries have indicated excellent possibilities for major gas production. On the other hand, of those 58 starts in that area, only 2 have found oil to date. One is indicated as having commercial oil, and probably the operations will produce commercial oil in the other one. Overwhelmingly, this area is a gas area, and I regard our situation in somewhat of the same way as a starving man, where you can make him as comfortable as possible with the finest furniture and everthing else, but unless you provide him with food he is still going to starve to death.

One interesting aspect of the accumulation of the gas in this area, is the fact that with the exception of the area immediately around Normandville and Tangent, the other occurrences lie 25 miles or more, one from another, so that it is an excellent sample of the area, the operations that have been done to date.

Another consideration of why it can be regarded as an area of high potentialities for gas, not only from the fact of our discoveries to date, but from our knowledge of the stratigraphical succession, is the fact that it has a very high percentage of excellent sand in it along the Mesozoic, and the occurrences, as

has been brought to the attention of the Board previously in testimony, the incidence of the Triassic and Permo-Pennsylvanian strata, which are of limited occurrences in Canada, in fact, in the world, and their rich development in this country has added to the whole picture with regard to the stratigraphical maps, as they do not occur in other parts of Alberta, and being of a porous nature, they suggest that they will be excellent reservoirs.

On looking at the distribution of gas over the Peace River region, the Gething sand and the Lower Cretaceous have, so far, offered the greatest potentialities. I have not had an opportunity of analyzing this problem along the line I would like to have done, and that is the relative proportions of the effective structure as against the pinchouts. Some of the gas accumulations are related to pinchouts or wedgeouts alone; others seem to demand that there be distinct structures possibly imposed by reefs, but it would seem in general with regard to the Cretaceous sands, and I am thinking of the Peace River sands with regard to the Lower Cretaceous, that that gas is in general there through pinchouts or wedgeouts, but as you get into the Paleozoic section, the Triassic and the Paleozoic into the Permo-Pennsylvanian and the Mississippian structures, there seems to be a necessity for accumulation, and I cannot comment percentage-wise or categorize the gas that has been found to date into those two types, but that would be done in an approach with regard to any analysis of the regional aspects of this area.

Q As I understand it, you say that you had four potential

pay zones which can be expected in the stratigraphic sections of this region?

A Yes.

Q Can you refer to those?

A Those are the Peace River sandstones in the Lower Cretaceous, the Gething horizon, in the Permo-Pennsylvanian and in the Mississippian. Whether the Triassic will be of interest in that area remains to be seen. We have also excluded the Devonian because, as is well known, there is a granite ridge which controls the major structure in the area, and, in part,has controlled the growth of reefs. It is probable that an appreciable part of the Devonian will be excluded from the section in that area, and, hence, we have not regarded it as potential in the area that I am speaking of.

Now, here is the Hudson's Bay well down in this particular area, and here is the Imperial well, and it is not far from other wells, but in this area over here the control was by geophysical work and our core drilling work, and as shown up by any standard, we have substantial structures. We hope that we will, at least, have some drilling in the fall of this year in those operations, but it is territory that is very difficult to get into. This area is very expensiveto operate in, with seismic operations costing from $25,000,00 to $40,000.00 per crew. And even more costly, if you take another unit as the basis of comparison, in the number of useful shot holes and number of useful records from the same, and it then appears even more costly than ever against Central Alberta, what we call the Central platform region.

Q Could those maps be left as exhibits, Dr. Beach?

A Yes, the Board is welcome to them if they care to have them.

THE CHAIRMAN: We will mark the map as Exhibit 31.

MAP OF PEACE RIVER AREA PRESENTED BY DR. BEACH, MARKED EXHIBIT 31.

THE CHAIRMAN: And the geological column will be marked Exhibit 32.

GEOLOGICAL COLUMN PRESENTED BY DR. BEACH MARKED EXHIBIT 32.

MR. McDONALD: Thank you, Dr. Beach.

.....

CROSS-EXAMINATION BY MR. STEER:

Q Dr. Beach, on page 3, with regard to Majeau Lake B-2 well, I notice that it is given 1,097 productive acres. Is that the acreage within which you find both of what you call your proved and your probable gas?

A I would have to inquire from our engineering department about that. I am not too sure about that. I took the figures they gave me, but I have not the information before me.

Q Perhaps you will let us have an answer to that?

A Yes.

Q And can you tell us what the BTU content of this gas is?

A Oh, I cannot, because our analyses have just come in and I have not got the information.

Q But you will be able to provide it?

A Yes, I think I can provide that information.

Q And I note that in the Glenevis A-1 well you have the

productive area with regard to this one well of 249 acres in the Viking sand, and 553 acres in the McMurray sand?

A Yes, sir.

Q And the same appears to be at the top of page 4 with regard to one of these Wizard Lake drillings of 381 acres in the Viking and 588 acres in the McMurray. We have had people telling us here that you establish a couple of thousand acres by the drilling of one well?

A A couple of thousand acres?

Q By the drilling of one well?

A Yes.

Q You do not agree with that?

A That is a commonly used criterion.

Q I say you do not agree with it?

A It should not be inferred from this that we agree or do not agree with that system. This is based on a projection of our thickness as determined in these wells on to our structural contour maps.

Q I see?

A It is a different method of approach. It is not a specific assignment to a well or a generalized assignment, it is specific to the structural data we have.

Q Yes? And that structural data would consist of?

A Very, very detailed geophysical work plus subsurface study.

Q And what relationship would it bear to sand thickness and connate water?

A I am not sure that I follow you.

Q You would have the sand thickness and the connate water from these wells in making up your minds as to what the area would be?

A Yes. We have detailed electrologs, we have sample logs, and the entire sections would have been cored, and we have the core analysis with regard to it.

Q And is it on that evidence that you base your area?

A That gives the one term of determining the area. You have the thickness of the sand as actually developed in the well, you have the extent of it over an area dictated by the structural data we have. That structural data comes from two sources, from pre-drilling detailed geophysical examination and from the tops that have been established by the well as it is being drilled.

Q Is that all the information that you have except perhaps from seismic examination of the surface?

A Not of the surface.

Q Pardon?

A Not of the surface, of the strata that contain the pay zones.

Q You mean the seismic picture gives you that?

A Yes.

Q I see. Well, my idea was that you ran the seismograph over the surface, am I not right in that?

A The actual transport units that carry the seismograph unit, or the seismic unit, are run over the surface, but the attempt is being made at that time to map strata at various depths.

Q Quite so. Quite so. So that you have whatever the seismograph gives you, plus sand thickness, connate water estimate, and the core analysis from which you compute your acreage?

A No, sir, the data that you specifically mention are not used in the computing of the acreage.

Q I see. They are used in computing the reserves in part?

A I would have to look that list over again.

Q Now, I would like you to tell us, perhaps, how you compute this 249 acres which you attribute as a productive area from Glenevis A-1 well in the Viking sand, just how is that computed?

A We had two factors, we had thickness of the sand known from the wells. . .

Q From this particular well?

A From this particular well. We also have the basis of comparison from the other well drilled 4 miles away, so that gives us a variability factor for that sand. Over and above that we know where the water occurs in the sand, and we have the form of the inverted cup, that is, the dome. . .

Q What did you say about the water?

A We know where the water line is from the actual drilling.

Q Oh, yes?

A We have also the form and areal extent of the dome which is presumed to be the trapping agent, so that if that is accurately known you can project the water level down to where it intersects that dome, and then if it were a perfectly dome-like field, it would be a triangle to revolution, but it is an irregular-shaped one, but you can compute the volume of the shape so found, and then applying that, or applying to that the porosity and permeability data that you obtained from the analysis of the cores, you are then able to compute a reserve of gas.

Q How do you arrive accurately at the existence of this dome?

A That is by a specialized technique that we have developed in collaboration with our lab. in Houston, Texas. As far as I know, it is a unique method, and I would not care to discuss it.

Q Could you have applied this method, we will say, to any well in the Princess area?

A The problems in that field are not the same. This particular method we use could not be applied, that I know of, in the Princess area.

Q Why not? Why do you say that?

A The conditions of the sections there are not the same.

Q By the sections, what do you mean?

A I mean the geological stratigraphical column.

Q And this map that you say is applicable to this area, that you have described to us here?

A That is right.

Q And is not applicable to other areas in the Province?

A As far as I know, it has been applied only in Venezuela and here.

Q And it is applicable in what portion of the stratigraphical column, is that a sensible question?

A It helped us to outline with great accuracy those gas occurrences at Majeau Lake.

Q Yes? You see, you told me that your method is not applicable in Princess because the stratigraphic column in Princess is different, is that what I understood you to say?

A I do not believe it would be applicable at Princess. I would have to consult witn our geophysical department to say for sure, but I think it would not be.

Q Oh, yes, perhaps I am asking . . .

MR. C. E. SMITH: What happened to this starving man?

MR. STEER: Do you want to quit now? Oh, yes, we were going to adjourn at 12.30, I forgot. I have one more question. I call your attention to a phrase that you use on page 2,

> "Nevertheless, in the interests of reliability we have distinguished between proven and probable reserves."

You do distinguish very clearly in your own mind between reserves that are proven and probable, or I think you describe them elsewhere as commercial, and those which are only probable?

A I would prefer to read the previous testimony that I have given before this Board before answering.

Q Before doing that?

A Yes.

Q I wonder if you could look at page 5 and I see there that you refer to commercial gas. I was going to ask you whether commercial gas and proven gas were synonymous terms to you?

MR. C.E. SMITH: That is probable.

A Yes, sir, with the exception that proven gas may be a non-commercial gas for some reason quite apart from its existence.

Q MR. STEER: Commercial gas is either co-terminus with proven, or it is something else?

A Commercial gas is?

Q Co-terminus with proven gas or else it is something else than proven gas? There may be some reasons why proven

gas could not be made commercial?

A If they are not co-terminus, the reason may not be with regard to the gas occurrence condition, it is due to some other condition.

Q That is all.

THE CHAIRMAN: We will adjourn until 2 o'clock.

(Hearing adjourned until 2 P.M.)

(Go to page 1031)

THE CHAIRMAN: Is there anyone wishes to question Dr. Beach?

MR. S.B. SMITH: I have no questions.

CROSS-EXAMINATION BY MR. NOLAN:

Q I want to ask Dr. Beach, if I may, sir: This morning you described to Mr. Steer, I think it was, this dome-like structure and the precise area that you were able to define with great accuracy?

A Yes, sir.

Q What would you expect to find, Dr. Beach, if you drilled outside of that precise dome-like area?

A The dome is not an entity in itself, it is a high part of a regional feature. In other words, the economic part. If you went away from it in this particular area you might go into an entirely different assemblage of rocks to the east, but to the west you should drill essentially the same section but it may not be located about the same place.

Q The dome-like structure does define the limits of the area?

A The economic areas.

Q If you drill outside of that to the west you might find what?

A If you drill to the west very probably you would get water in the same reservoir.

Q But if you drilled to the east?

A There are rather peculiar circumstances here. This structure occurs at the edge of a thick series of strata

as Mississippian. The reservoir itself is developed in massive Limestones and Dolomite. They end quite abruptly as cliffs and as a result drilling to the west you will penetrate essentially the same structure as you did in the well which was our discovery, but going further east you lose entirely the Dolomite section. We already have a dry hole to prove that contention.

Q And having lost this Dolomite section, as you call it, what would you expect to find?

A It would be immediately from the Lower Cretaceous, the sands and shale series into the Banff formation, which is a thin bedded silty Limestone and Dolomite. It occurs at all places where the Mississippian is developed or substantially under the mass of granoidal Limestone. I may call it the Madison, even though that is not a precise term. In most places in south western Alberta if you drill down through the Cretaceous you will come out to the Madison, and underlying it is the Banff. This accumulation that we are discussing lies at the truncated edge of the Madison. As a result, going east you lose entirely the Madison, you go directly into the Banff.

Q And it would be essentially a wildcat well, would it not?

A To go to the east to drill?

Q Yes?

MR. C.E. SMITH: Probable.

MR. NOLAN: Well, take a possible or a potential well.

A I am afraid I have to know your concept of a wildcat.

MR. C.E. SMITH: It is like my own, something that lives in trees and claws.

Q MR. NOLAN: Well, my concept of a wildcat, Dr. Beach, is a well that is drilled without much data or information from nearby wells. Is that a fair definition of a wildcat?

A Without much data or information from nearby wells?

Q Yes.

A That is, it owes the name wildcat merely to the fact that it is drilled in a previously undrilled region?

Q I think that is right, yes.

A Assuming that you have some specific distance in mind from a discovery when it becomes a wildcat, then I am sure drilling to the east of that would be so classed as a wildcat.

Q I mean, just outside of our precise area that we have been talking about, just outside.

A I believe, yes, that if you were to locate a well knowing that it was going to fall off the cliff of the Mississippian it would be non-productive, of course, because of the non-existence of those and it would be classed as a wildcat.

Q MR. STEER: A wildcat might hit the Mississippian?

A There is a bit of philosophy in drilling a wildcat, you are not too sure what you are going after.

Q Sure.

Q MR. MACLEOD: It could be wild to the extent that you would know that the dome is not there on your

assumption?

A There is always the possibility, I think most geologists will admit, along those wedge-outs or pinch-outs there may be isolated occurrences of those beds as the smaller domes, the contact sand, absolutely sharp running straight across the country, so those possibilities have to be taken into consideration.

Q MR. STEER: Is it your conception that the Mississippian formation would end abruptly or would it thin out at the edge?

A Apparently it does both.

Q There are some cases?

A We know areas not far from this Majeau Lake development where apparently there is no cliff development at all. It seems to be a function of the extent of the development of the stream pattern and the Paleozoic pattern at that time, they were raised and curved by quite a large stream panelling. In some areas it located those extreme cliffs. The Mount Rundle in Banff is some indication of those we are speaking of, ending abruptly in cliffs.

Q In other cases it would pinch out at the edges?

A Running from the full thickness of the formation down to inches or infinitely small.

Q Have you got the same idea on the reef in the Leduc area, you get over the edge of one of those reefs and you get nothing?

A That is correct. The cause, of course, is quite different, the reef being limitations of the biological

development, the other functional erosion. They have the same limitations but they do not extend forever.

EXAMINATION BY MR. C.E. SMITH:

Q Dr. Beach, referring to the bottom of page 2 and the top of page 3 of your submission, Exhibit 30, you mention 4½ miles apart between the two wells, then you say this:

> "A third well, Texaco Majeau Lake No. C 1 is shortly to be located to the north of Texaco Majeau Lake B 2, and if it confirms our expectations substantially greater figures for both proven and probable reserves might be justified."

Can you briefly tell us where this third well is in relation to the other two?

A Yes, it would be in the order of three or four miles north of Majeau Lake No. 2. I may be out a mile or so in that. It is a question of obtaining service rights at the present time. That is why we have not located it.

Q Then where is it with respect to the other one? What is it called, No. 1?

A This will make the third well in a trend of which the most southerly is Glenevis No. 1, or 1-A. The Majeau Lake No. 2 lies 4½ miles on the north of it. This well will lie some 3 or 4 miles to the north of Majeau No. 2.

Q It is not anywhere in between?

A No, sir, it is an extension to the north.

Q Mr. King wants to know is it in your present probable area?

A It is just on the edge of it.

Q What would you expect to find there? You say:

"our expectations substantially greater...."?

A It is because of a saddle condition that lies between our present Majeau Lake -- the Majeau Lake well that we plan on drilling off the saddle is so deep that it could create a separate water table and thus give us two distinct structures. Our analysis of the reserves will be different. Then if in drilling the C 1 well we get exactly the same water table and pay and hydrocarbon content, we would be justified in assuming we are dealing with the same saddle and the saddle is a minor deflection rather than major.

Q Do you suggest now as between Glenevis and Majeau B 2 each have got the same structures throughout that 4½ miles?

A There are apparently some saddles but they are not likely deep enough to. Put it another way, the Glenevis well is apparently on a distinct high on the same trend, something like the domes on a steam boiler. There is the steam boiler going the entire length of the structure but there are distinct highs dotted along.

Q Now, what I am getting at is, I wonder if you do expect or hope to find that Glenevis and Majeau B 2 will constitute one whole area, so to speak?

A No, Glenevis we do not regard as lying within the gas area of Majeau 2, but why it is important to this picture is because it gives us structural information that confirmed our pre-drilling interpretation of the structure, something that is relatively unique.

Q You do not mean by that it is unique to find what you

expected? Is that what you have in mind?

A That is probably rather flattering to the profession.

Q Well, you are frank, anyway.

A Our geophysical department in general wants a leeway of 50 feet or more either way. They predict certain horizons. In this case two wells have hit between 5 feet of their predicted depth, which I think anyone familiar with that type of operation will consider quite remarkable.

Q Deserves a medal?

A Yes.

Q I could not quite follow when you were discussing with Mr. Steer your acreage as shown on page 3. As he mentioned, and probably we are all a little disturbed about some people taking 2,000 acres around one well, or roughly that, you remember?

A Yes.

Q And you have got 249 for Viking and 553 for McMurray. I could not quite follow how you got it down that low for a change in this Hearing.

A I think if you would visualize a cone standing with its point upwards, a 1-inch band painted on the cone half way down and another one two-thirds of the way down, one would cover considerably more area than the other.

Q I can understand that part of it.

A We feel we have the shape of the cone pretty well established and the well has determined where the sand lay relative to that cone, so then it is just a case of projection of the intercepts in the well out to the margin of the cone to give you a 3-dimensional picture

of the extent of the sand.

Q Tell me why some other people can not find the cone with a band up here and another one down there instead of giving us 2,000 acres? What is the difference between the way you do it and the way the others do it?

A This is a unique case we are talking of. This is somewhat akin of a Foothills structure, not any structural characteristics. That is, Foothills structures are without structures themselves, roughly pre-buried by the -- I believe I can point it out this way, in sand play such as Viking accumulations and to some extent Lower Cretaceous accumulations there can be high variation in the reservoir, in the sands, and there is no method that I know of other than drilling that can predict that. We have found that at Manyberries. One might assume that we knew sufficient to go out and drill continuously productive wells but it is still a hit-and-miss proposition in many respects, but here the reservoir can be quite accurately defined.

Q Well, is there any place in Alberta that you have knowledge of where you would use this 2,000 acre idea? I gather you are not very fond of it from what you have said.

A I did not want to leave that impression.

Q Okay.

A I believe my answers to Mr. Steer's questions were in effect that I neither condemned it nor condoned it.

Q That does not help us much, we want help.

A I did not want you to infer that I had condemned it.

Q I take it then that where you have nothing else you can

use you might as well take that as anything else.

A And we have done essentially that in the Smith Coulee area. I did not know what else to do. Once an organization makes an assumption those are the rules of the game and you go from there on, and I believe that that assumption has been tolerated by your Board.

Q Well, I won't answer that. I don't know, thank goodness. But you can see what I am getting at, a layman to look at your table with 249 and 553 and look at some others where they stick in 2,000. I wonder if you can help out, that is all.

A The situation is quite different in that conditions in this particular field we are discussing can be predicted with a fair degree of accuracy. We assume those porous horizons go for miles and miles. It is merely a question of the water line cutting them off. In sand play the reservoir itself may not be continuous from one section to another. It can not be predicted very accurately.

Q I presume the accuracy of your estimates and methods is something you do not want to discuss?

A I am not in a position to make the data from which we derived those computations public.

Q Well, you have some idea of method or system that apparently is not public knowledge at the moment, is that so?

A Yes, sir.

Q That is all.

CROSS-EXAMINATION BY MR. STEER:

Q Do you have any idea, Dr. Beach, why these people who were using the 2,000 acres per well estimates sometimes take 1,000 acres as the proved area surrounding a well?

A I do not think I could contribute. One is more conservative than the other, that is the only aspect I can think of.

Q The same man takes 2,000 around one well and 1,000 acres around another well. I am wondering why?

A Then if he feels justified in doing that, I assume he recognizes some fundamental difference in the character of the reservoir in the two cases. If it were Limestone the 2,000 might be much more accurate and reasonable than taking 1,000 around certain types of sand play, Limestone being noted for being the more continuous type of reservoir. I do not know whether that is helpful or not.

EXAMINATION BY DR. GOVIER:

Q Dr. Beach, the reserve figures that you have given us on page 3 are gas in place, is that right?

A On page, what was that?

Q Page 3 and page 4, 2 for that matter. They are gas in place in the reservoir?

A Yes, sir. You will notice at the top of the table that it says "Proved Reserves in Place".

Q Do you have any ideas on a reasonable abandonment pressure for those particular reserves?

A I could not offer any constructive opinion on that. I could ask our engineering department to make it available

to you, what they think.

Q Do you have any idea of the percentage of the gas in place that might be recovered and put to market?

A It involves a problem that I am not familiar with, Dr. Govier, and that is, how efficient the extraction of the naphtha gas is. I presume that all gas once the naphtha is extracted is available for commercial use but I am not --

Q That is fine, Dr. Beach, if you would rather not tell me.

A I am just not in a position to comment on it, I am sorry.

Q In the column for reserves, you have reserves for two sands. Is it your thought that the two reserves might be produced through dual completed wells, or would one reserve be produced and the other follow?

A The other reserve would follow from that.

Q So that one of those reserves would probably be reserved until the other is produced?

A Until the other one is produced.

Q Is that just on a basis of reasonable economic production?

A I believe there is an engineering hazard in doing that. For one thing, wells cannot be readily serviced as dual producers, I think is one argument that is used against them. Of course, if there are pressure differences between the zones, I think trouble could come about.

Q In other words, Dr. Beach, you give this proved, two figures, one for proved and one for probable. Would you think that the Board might assume that the total of those two is the amount of gas that the Province can reasonably

count upon or would you consider only the proved, or what is your thought on that? How do we get from your figures to the figure that we can count on?

A My own feeling is that there is, -- it is a very good bed -- that the reserves we indicate as proven and probable will ultimately be available. It hinges on a rather peculiar situation. Geophysical work may be very accurate on the top of a structure and yet I visualize it like an umbrella, you can move the umbrella up and down and the slopes can change, so the boundaries of the productive areas could vary a little bit, but whether that would change the reserves by 5 per cent or 25 per cent I am not at all sure. We are having that same problem at Wizard Lake at the present time in the interpretation of the seismic work.

Q I would take it, though, what you consider and you class as proved as being pretty certain?

A Yes.

Q There is no doubt about that part of it?

A Yes, I feel quite confident that anyone could take those proved reserves as existing and being available.

Q But there is some doubt as to the amount of probable in the other category?

A In so far as we have not punctured it and proved beyond doubt that it is there. We are stepping out further in saying 4 miles then is normally tolerated.

Q If one were able to estimate the odds, I suppose you would take the 82,000 and multiply it by the odds you would expect, is that right?

A I think that would be fair treatment.

Q Suppose there was a 50 per cent chance of getting that, I suppose you would say we should probably not count on more than half of it?

A I think it would be safe to do business on half of it, that is, that you have almost a certainty, of as much as there is certainty in this type of operation, of getting half of it. You might ask why would we not put that into the proved reserves, but we have declared an area around the wells and the detailed nature of the structure has permitted us to say that that small part of the reservoir beyond all reasonable doubt contains the gas that we have placed in the proved class. If the reservoir is in continuity of its general characteristics at all then it is equally reasonable to assume that what we have classed as probably will also be there.

Q But there is some uncertainty in the continuity of the reservoir and for that reason there is some uncertainty in the probable?

A The probable in a sense reflects almost like a square curve away from the well, the decrease in the factual data that you have to predict.

Q Dr. Beach, in discussing this same matter with Mr. Dougherty, I do not believe you were here?

A No, I was out of town, I am sorry.

Q Well, in discussing it with him I was asking him if he thought it reasonable to assign a certainty of 100 per cent on those reserves which were in the highest position in his proven category and a certainty of 0 per cent on those reserves which were in the lowest position in his third and possible category?

A Okay.

Q And Mr. Dougherty thought that that was a reasonable thing to do?

A Yes.

Q I then asked him if he felt that in attempting to arrive at the reserves whidh the Province could reasonably count upon if it would be proper to assume that there was some gradual change in the degree of certainty from 100% at the one end to zero at the other end, do you follow me?

A Yes.

Q Through his three categories of reserves?

A What were the three categories?

Q His three categories were proved, probable and possible.

A Yes. And then he superimposed on these three categories zero to 100?

Q No, he did not, but he felt that it was reasonable that at the top of the proven the certainty was 100?

A Yes.

Q And at the bottom of the possible the certainty was zero?

A Yes.

Q He also felt that it was reasonable to assume that there was a gradation from 100 to zero through his categories?

A Yes.

Q And Mr. Dougherty was of the opinion that that gradation might be of the type which would reflect a high degree of certainty, nearly 100% all of the way through the proven category, but would then fall to lower values, and I believe he suggested 75 to 85% certainty in the middle of the probable, and below that down to zero at the bottom of

the possible.

A It would seem to me that another factor is required that hinges very much on the discussion that we have had, that is related to the type of structure. I would have more faith in a Foothills structure in which there is good structural information with one well than I would, say, on a Viking sand zone with 7 wells. I think you can appreciate the reasons for that.

Q Yes, I see your point and I think that should be a factor added to the other.

A The distinction seems reasonable to me, but I think that should be a factor, possibly, as compared with the Viking sand reserves; for instance, I would regard that as what we class as probable reserves approaching very close to the proven with regard to the sand.

Q I see.

A Because of known characteristics of the reservoir to continue over long distances, so the only thing that you are faced with really is whether the water table is going to be a flat surface intersecting that. Of course, if it is warped, it is another problem, but they are uncommon.

Q I believe that you would be consistent with Mr. Dougherty's statement that there were all gradations, and I assume that he meant depending on the type of structure, amount of information, etc.?

A I am sorry, I have not read his testimony.

Q In the case of your figures, Dr. Beach, and in the light of this discussion that we have had, would you care to hazard any sort of a guess as to the percentage reliability, and I realize it is extremely difficult, but I feel that

you, perhaps better than anyone else, are the best one to do it?

A Would you mind just giving me the figures again, the proved, probable and possible, and what the proved ran in his scale, between what?

Q Well, I do not want to mislead you on that. Mr. Dougherty did not have any scale, but he was agreeable to my suggestion that the top of his proven was 100%.

A 100%?

Q Yes. And the bottom of his possible was zero?

A Yes.

Q Now, I actually suggested to him that there might be a linear relationship all the way through, which would put the bottom of the proven at 67%. Mr. Dougherty thought that was unrealistic, and that all the way through the proven the reliability would be quite high and quite near the 100%. He did suggest a reliability of perhaps 75 to 85% for his probable category, but he qualified that to the extent that he said that that would completely disregard the possible, or the future possibility.

A That that would disregard the future possibilities?

Q That that would give no regard whatsoever to what the future will bring, which is on the basis of present day knowledge.

A I am still trying to think of the variance that determines the limits between probable and proven in such a category.

Q That is what the Board is trying to find out too.

MR. C. E. SMITH: He made a good answer when he said a very good bet for probable. Many of those I have lost when the horse finished down the track too.

A That just follows the laws of chance, just the same as horse races.

Q I agree with you, but I hope not in this case.

A I would be inclined to think that our problem would fit in that category of 75 to 85, and yet I could not argue why I did not set the boundaries at 60 and 90.

Q DR. GOVIER: That would apply to your figure, for example, of 82,625 on page 3?

A Yes, sir.

Q Well, that would mean then, I imagine, Dr. Beach, that in trying to arrive from your figures at what we could count on we might take the 23 billion and we might add some fairly large fraction of the 82 billion?

A Yes, sir.

Q And then make the appropriate deductions for abandonment, reservoir loss, shrinkage, etc.?

A Yes.

Q And get through to marketable gas?

A Yes. I think it would not be unrealistic to take the 23 billion, plus 65 or 75% of the probable reserves.

Q Or maybe just two-thirds of the probable?

A Two-thirds of the probable?

Q Yes.

A I think that would be reasonable, even to the point of being conservative.

Q Now, would you use that figure of two-thirds of the probable in other reserves, say in the Lower Cretaceous sand reserve, or would you be inclined to take a higher or a lower figure?

A I would find the Lower Cretaceous among the hardest of the formations to generalize on. In certain areas in Alberta it remains generally constant over a considerable area; in other places it varies within quarter sections so markedly. We have electrologs in which the nature of the Lower Cretaceous from one well to another is scarcely discernible, and then again whole beds have gone in the matter of a quarter of a mile. In other areas the Lower Cretaceous was as uniform as the black shale at the bottom of the hole. I think that is what I had in mind when I said that some other factor or category is necessary in this appraisal. You might assign a further factor of .8, .9 or 1. Once the reservoir characteristics or the structural characteristics of a limestone reservoir have been developed, the projection of it is relatively a simple matter, and you might want to class that type of reservoir as 1, and then sand deposits which extend with generally similar characteristics over an extensive area, you might want to class as .8, and correspondingly down to thin beds under 2 feet in the Viking that I would class very low down because of their high potentialities of variability. Of course, penetrating sands that are 2 feet thick in succession, until further drilling is done, you have no way of saying you are on the thin edge of a 10 foot sand or on the thick edge of a 6 inch sand.

Q Would you superimpose that reservoir classification on the top of a sort of probability curve then, or would you use it as a substitute?

A I would not like to give a snap judgment on that. I would want to puzzle with it, some. I do not know for sure.

Q Dr. Beach, suppose that we were considering totals for a large number of reservoirs of all kinds, such as the totals submitted to us by DeGolyer and MacNaughton for the Province, and suppose those totals are in three categories, proven, probable and possible, and since we have a large number of fields included, probably some statistical approach is reasonable because certain factors will cancel out, I imagine, . . .

A Yes.

Q . . . in considering those tables do you think it would be reasonable to apply some kind of probability discount factor to the three categories in order, of course, to get that gas we can count on today?

A Yes, I think it would, but in formulating that discount factor several intangibles might have to be considered. Taking it first of all from a regional standpoint, such considerations as this may have to be considered, those which lie in a region which has shown general uniformity of that type of reservoir over an extensive area. You could draw a general line across Alberta and say that West of that the Viking is fairly uniform. It will show local variations, but in general it maintains a fair uniformity to its blanketting. Now, East of that line at best the Viking can be expected only as spotty lenses. That is one type of regional consideration. I think also that whether the occurrence itself is known for one or more miles, I think that is significant in itself. If the reserves are based on a well which has 10 feet of sand, there being 10 feet of sand in this one, and another one 4 miles apart with 6 inches

of sand, I am not sure that it is fair to average the 6 inches of sand and the 10 feet and declare it to be a uniformity, but without other data some such process is necessary. But I think in terms of the probability factor you spoke of, that is where it should be applied, yes, sir.

Q I take it you would then rather see that happen on a field basis rather than on a total?

A Yes, sir. From experience, applying it there, there certainly is a very considerable mass of data here now which would permit some sort of sample on the basis of a true strike area, and then try with some over-all factor and see how the two check. I just have no idea how it would work out.

Q It is really the problem of putting a number on doubt?

A That is just exactly it. You cannot solve the possibility, or overcome the possibility, that a reservoir which you would be prepared to back substantially is continuous, you cannot entirely take it that intrusion of some kind or another may not come in and cut it off. That is a possibility, and has occurred, but the realm of probability argues against it.

Q Thanks, Doctor.

EXAMINATION BY MR. GOODALL:

Q Dr. Beach, is there any gas found in the Mississippian in the Glenevis?

A It is not commercial, Mr. Goodall. My recollection is that it is on the order of 50,000 shown on drill stem tests.

Q I think that is all. I was wondering about that one problem.

EXAMINATION BY THE CHAIRMAN:

Q Dr. Beach, on the first page of Exhibit 30, dealing with the Manyberries, you mention that there were three wells drilled there since you made your original estimate for the Board?

A Yes, sir.

Q And that two of those wells were abandoned, and the third one, you cased it, there has been no production test. In the case of those two abandoned wells, did they fall within the proven area that you based your reserves on?

A No, they did not. They were tested.

Q They were tested?

A Yes. That is why we made the statement. We contoured those wells on our isopachous maps and the information that came to us on them does not change our reserves.

Q But there were gas shows in those sands?

A Insignificant amounts, in fact one was wet, that is my recollection.

Q Thanks, Doctor.

Q DR. GOVIER: That dry hole data, I suppose, would lend considerable support to your previous reserve figures, in addition to not changing them?

A Yes, sir. A good example of that is in the Pendant d'Oreille part where much of the greater sand lenses lie below the water. There is a very substantial lens up as much as a township and a half or more that it would cover, of which the upper margin is the gas bearing part, so that in that respect the drilling of dry holes and wet holes helps you to formulate very accurately your boundaries.

CROSS-EXAMINATION BY MR. PORTER:

Q Dr. Beach, I want to come back to the bothersome question you were discussing in an attempt to help Dr. Govier. Three classifications have been set up, proven, probable and possible, and with regard to those Dr. Govier has been hunting for a discount factor and sought your help.

A Yes, sir.

Q If we were to assume that in making those classifications the author of that conclusion had already made his discount on account of field characteristics, it would lessen the discount that you have been talking about, wouldn't it? If he had allowed for the characteristics in the Viking, and the difficulties of accessibility, before he put these various fields under the various headings, you would expect a higher accuracy, wouldn't you?

A Yes.

Q And, therefore, you would apply a smaller discount?

A I should like to know who was applying the discount, is it an engineer or a geologist?

Q We are just talking about the discount that Dr. Govier was trying to find and get your opinion? A. Well . . .

Q Well, let us assume that he has done that. Then the higher the accuracy would be of the classification, I am suggesting,and the lower the discount would be after the classes are set up.

A What I am suggesting to you is that I could not say "yes" or "no" as a blanket statement to your question. Whether I would consider the discount treatment given by one group is similar to that given by another group, I would want to

know who had made the discount, not personally, but I would like to know his scientific training and, hence, his philosophy towards this type of thing.

Q And you would have looked at his work or you would have liked to have heard about his work and reviewed his evidence?

A Engineers, in general, the discount would be more a strict rule of thumb percentagewise; geologists would be more inclined to take into consideration intangibles. Now, possibly engineers discussing these problems that have been dealt with at some length would not be as impressed with the distinction of a fundamental characteristic of a reservoir such as Majeau Lake as against another reservoir as a geologist.

Q Let us assume you have a geologist who says "I realize these difficulties" -

A Yes.

Q A geologist who says "I realized these difficulties, and before I set up my classifications I took these geological characteristics and hazards, and before I put in any of these estimates into any of these classes, I had made a discount for those characteristics and hazards." Now, then, I say to you, or I suggest to you that being satisfied with the accuracy of his work, or some of his work, rather, would you apply a similar discount factor to the results that you would if you did not have that original discount in accumulating the information?

A I infer your question to mean, does it make any difference whether you take your discount early or late.

Q No, because the discount Dr. Govier is talking about is on the result after the author claims he has taken a discount.

MR. C. E. SMITH: Surely the odds drop from 5 to 1 to 4 to 1; that is all that means.

MR. PORTER: I do not want figures; I haven't any horses.

MR. C. E. SMITH: You have got a lot of them, what are you talking about?

A I am afraid that becomes involved in a question of . . .

Q MR. PORTER: Well, all right, let us both give up.

MR. S. B. SMITH: Could I ask a question, sir?

THE CHAIRMAN: Yes.

Q MR. S. B. SMITH: Isn't this the position, Dr. Beach, or isn't this position a fair position, that before you would want to consider setting up any discount figures to any classifications set up by any person, you would want to know fully how they set up those classifications, wouldn't you?

A Very much so, yes.

THE CHAIRMAN: Thanks, Dr. Beach.

MR. MACLEOD: That is all the evidence we have.

MR. S. B. SMITH: On behalf of Prairie Pipe Lines Limited and Prairie Transmission Lines, Limited I am calling Mr. Robert R. Herring. I think the Board have copies of his submissions. I might say, sir, that for once I have ample copies. If there is any person who wants a copy who has not

a copy, we have ample available.

ROBERT R. HERRING, having been first duly sworn, examined by Mr. S. B. Smith, testified as follows:-

Q I think the Board knows who Mr. Herring is and I am going to ask him to proceed with the reading of his submission.

THE CHAIRMAN: That submission will be marked Exhibit number 33.

MR. S. B. SMITH: Number 33?

PROPOSED NATURAL GAS DELIVERABILITY SCHEDULE SUBMITTED BY PRAIRIE PIPE LINES LIMITED MARKED EXHIBIT 33.

Q MR. S. B. SMITH: Would you please read your submission?

A Prairie Pipe Lines Ltd. respectfully submits in this presentation a deliverability study for southern Alberta developed to meet the full requirements established for the Canadian Western Natural Gas Company system by the Petroleum and Natural Gas Conservation Board in its Interim Report, dated Jan. 20, 1951, and to provide for an export volume of two hundred million cubic feet of natural gas as peak requirements with an average take representing a 90% pipe line load factor.

Full consideration has been given to the more recent discoveries of natural gas in the Province as presented by the various experts, but more particular emphasis has been placed upon the proven reserves submitted by DeGolyer and MacNaughton. Prairie Pipe Lines Ltd. accepts these proven areas as representing dependable reserves of natural

gas, and also gives serious consideration to the probable reserves as established.

As discussed in the Board's "Interim Report", however, the serious problem remains of the proper employment of these reserves to meet the future maximum day requirements of the Province without materially increasing the cost of gas to the provincial consumer. On page 45 of the "Interim Report" the Board points out two possible plans that may be developed in supplying the C.W.N.G. system requirements. That is, "the development of a storage field, capable of high deliverability to meet winter peaks;" or, "by the use, along with Pincher Creek, of a dry gas field capable of good deliverability and economically capable of operating at a very low load factor; such a field might be used with Pincher Creek much as Foremost is presently employed with the other fields in the C.W.N.G. system."

We have seriously considered these two approaches to the problem in the light of the more recent discoveries of natural gas. We cannot recommend to the Board at this time a program involving additional storage for the C.W.N.G. system because of the questionable aspects of the possible reservoirs immediately adjacent to the Calgary market, the expense of experimenting with any such reservoirs, the promises afforded by the more recent discoveries just north of Calgary which may materially affect any storage program, and the cost of extending facilities over 200 miles to the more promising sand reservoirs in southeastern Alberta. Any such program involving large expenditures cannot be recommended at this time because of the many unknown factors

and the period of nearly ten years which must elapse before these facilities could be utilized by the local Company.

Because of these facts the Prairie Companies present a plan encouraging the development of the reserves in the areas between Cessford and Medicine Hat. The present proved reserves in this area, when used with Pincher Creek development, will fully satisfy the export line requirements up to 200 MMCF/Day and the C.W.N.G. system requirements. We commend this plan to the Board because of the "cost factor" with respect to meeting the future requirements of the southern part of the Province. Any efforts to develop these two areas by the local Company alone will undoubtedly result in considerably increased cost to the southern Alberta consumer.

The Petroleum and Natural Gas Conservation Board has made their position quite clear with respect to meeting Provincial requirements, while at the same time the Board and the Government officials have assured the applicants of a favorable export decision when a sufficient surplus has been established.

PROPOSAL

As shown on the attached map (exhibit #3) and the deliverability schedules (exhibits #1 and #2) we have designed a system to draw gas from five particular areas; namely, Cessford, Countess-Brooks, Medicine Hat, Princess-Patricia, and Pincher Creek. The combined proved reserves of these areas now exceed two and one-half trillion cu. ft. of natural gas. The proven and probable reserves now exceed three and one-third trillion cu. ft. When added

R. R. Herring,
Dir. Ex. by Mr. S. B. Smith.

to the present reserve connections to the C.W.N.G. system the proven reserves connected to the export line and the local system exceeds three and one-third trillion cu. ft. The export line as shown in exhibit #1 would require one and one-third trillion, leaving over two trillion to the C.W.N.G. system. The only capital investment required of the local system in acquiring these developed reserves, which I might add would be on a peaking basis, would be the looping of the main line from the junction near Claresholm into Calgary, and this can be done on a gradual basis as required.

(Go to page 1059.)

R. R. Herring,
Dir. Ex. by Mr. S.B. Smith.

A FIELD AVAILABILITY

PINCHER CREEK

A suitable method of developing the Pincher Creek field for local use was briefly explored by the Board in the "Interim Report". The difficulties in such a program was quite obvious. For the purpose of this schedule, we have established a peak day delivery of one hundred and twenty-five million cu. ft. per day with an 80% load factor operation through the twenty years of export. During the last ten years of the thirty year period we have reduced the peak day to one hundred million cu. ft. and placed the load factor at 75%. The evidence supports that the field can be economically developed on this basis. The thirty year period will consume 950 billion cu. ft. leaving from two to six hundred billion still in the reservoir at the end of this period. That is all recoverable gas. From the evidence presented at these hearings the field will easily support this schedule.

COUNTESS BROOKS

The probable reserves of these two areas are considered promising and we have shown a 30 year withdrawal in excess of the actual proved reserves. The present proved reserves are approximately one hundred billion with the probable areas extending this to two hundred and twenty billion. Our withdrawal as shown in exhibit #2 reaches a peak of 30 million cu. ft. per day and totals one hundred and twenty three billion. We have purposely extended this area beyond its proven

limits to encourage a wider development program. In the event the field does not prove up we have a large surplus of proven area in both Cessford and Medicine Hat and would adjust our withdrawals accordingly.

PRINCESS - PATRICIA

These areas have also been handled in the same manner. The proven and probable area exceeds three hundred billion but due to limited development the proven is only one hundred billion. Our scheduled withdrawal totals one hundred and eighty-seven billion cu. ft. with a peak day of 44 million cu. ft. Again, however, we have retained a margin in Cessford and Medicine Hat to protect the full supply requirements.

MEDICINE HAT and SUFFIELD

With the recent development of the Britalta Company the proven and probable reserve of this field now exceeds eight hundred and twenty billion. The proven area alone exceeds five hundred billion. With sufficient reservation for local use we have estimated that three hundred and fifty billion of proved area is available. Our withdrawal over thirty years totals two hundred and seventy-five billion, which leaves a reserve of over seventy-five billion in the field.

CESSFORD

The proven area of the Cessford field now contains over three hundred billion cu. ft. and with the probable area exceeds four hundred billion cu. ft. The withdrawal as shown in exhibit two totals one

hundred and eighty-seven billion cu. ft., leaving a margin after thirty years of more than one hundred billion cu. ft.

S U M M A R Y

It will be noted on comparison that the deliverability schedule of these fields is considerably below that established by the various experts. Three basic reasons may be used to explain the estimates.

(1) the estimates of deliverability must cover only the proven areas and must have a margin of safety to cover the many unknowns of deliverability estimation.

(2) the estimates have been established on the basis of actual requirements with a consideration of the marginal safety factor, but varied to promote the widest development and exploration possible within the limits of establishing an economically sound project.

(3) the estimates have placed emphasis on the cost of gathering the gas, treating the gas, drilling the wells and transporting the gas at economical pipeline pressures.

The plan as illustrated will meet the full requirements of the C.W.N.G. system and the export line on the most economic basis for the local consumer and the producer of the gas. Naturally this will also apply to the local gas Company and the export Company as well. Without such an export volume the cost of development and transmission would be almost prohibitive to the C.W.N.G. system. As pointed out by the Board and Mr.

Ralph Davis, "The Pincher Creek field, despite its undoubtedly large reserve, is not as attractive as could be desired, first, on account of its distance from the main market, the city of Calgary, and second, because of the high capital and operating costs involved in producing the gas". To a lesser degree of development and operating costs this statement may be applied to the other fields covered in this submission. As previously discussed the availability of an adjacent, suitable storage reservoir is still an unknown factor and will remain so for some time. The answer to the future delivery of relatively low cost peaking volumes must therefore be obtained in some other way if immediate export is to be allowed. The program which we have outlined will cause full field development in the various areas, and a connection will be made with the C.W.N.G. system. The new facilities will then go through six years of rate base depreciation before the local system will begin to call for peak deliveries. The volumes at that time plus this depreciation should provide a very economic service cost on the volumes supplied to the C.W.N.G. system.

C O N C L U S I O N

In submitting the recommendations of the Prairie Companies, we in no way change our previous application to the Board in which we agree to take any volume from 100,000 Mcf. per day up to the full requirements of the Pacific Northwest markets. We have recently filed with

the Board of Transport Commissioners in Ottawa a strong request for permission to provide the Pacific Northwest Pipeline Corporation with sufficient gas at the British Columbia-Washington border to allow a full exchange of Texas gas at the Ontario-Michigan border for reciprocal exchange service to cities of eastern Canada as previously applied for before this Board. We fell that the plan as outlined will provide the basis for such an arrangement to the benefit of both our nations.

Q Mr. Herring,with reference to the subject last discussed in the conclusion, that is, this reciprocal exchange service, would you like to enlarge on that and tell us a bit more about it.

A To bring the Board up to date on developments between the Pacific Northwest Pipe Line Corporation since the testimony last fall, we have the natural gas of which I speak here, and when I say Texas gas, under agreements with the El Paso Natural Gas Corporation and they deliver at Dumas, Texas. That gas is approximately 1100 miles from Windsor, Ontario, and approximately 550 miles further from Montreal. Accordingly, about a 1600 mile pipe line would be required to deliver this gas from its Texas delivery point of the El Paso Company in the States to Eastern Canada and the City of Montreal. Our plan is as we have submitted, that if we could receive from Alberta for the Pacific Northwest Pipe Line Corporation service to the Pacific Northwest markets of sufficient gas to create an economically sound pipeline to Eastern Canada, we would exchange foot by foot this gas from Texas for the gas

from Alberta. We feel that such a move on the part of Alberta and the regulatory officials both in the Dominion Government and in the F.P.C. that many of the problems which have faced previous export of gas to the Eastern Provinces of Canada could be overcome.

Q That is, the difficulties about exporting gas from the United States to Eastern Canada?

A Yes. In view of the demand of existing utilities in so far as our plan would completely dedicate this Texas gas for service to Eastern Canada in exchange for this received up here. It is essentially the same plan we discussed for the Board last fall.

Q Mr. Herring, have you got anything to say about the service of smaller towns and urban points within Alberta on the route of your proposed pipeline?

A On Exhibit No. 3 it will be noted that the pipeline passes, both the gathering lines and the transmission lines pass in close proximity to several of the smaller towns of Alberta which are not presently served by natural gas. Quite naturally we would make available at our pipeline gas for service to any of those communities as directed both by this Commission and by the Public Utilities Commission.

Q Anything further you wish to add, Mr. Herring?

A The only thing that I might discuss in addition to that is the matter of steel. As explained to the Board last year, we have contracted for steel at a mill space of sufficient quantity to meet the requirements of this project. We acknowledge the fact that since that time

our steel in the United States has gone on a full priority basis and that allocations must be made from Washington for its requirements. We have had many meetings with responsible Government agencies in Washington relative to our contracts in this field. We have nothing to present the Board in the way of a firm position from Washington because until we have a firm project we can not secure that. We have received the greatest encouragement for this allocation because of the very great need in the Pacific Northwest, and of which the Board is thoroughly familiar, through the Munitions Board, letters and various other announcements. Probably atomic engergy plants up there will adopt a very sound basis for steel allocation. We can only give the Board our feeling that we are relatively sure of ourselves with respect to those contracts and they are still in existence.

MR. NOLAN: I was going to ask you a question arising out - -

THE CHAIRMAN: Would you mind waiting just one minute, please. Mr. Smith, did you distribute an amended copy of your application to all interested parties?

MR. S.B. SMITH: No, we have not. I have not the copies here. They have been filed with the Board and I will be glad to make those available to anyone who desires them.

THE CHAIRMAN: I thought that possibly you might like Mr. Herring to read the proposed amendment or make it known.

MR. S.B. SMITH: I will be very glad to do that.

THE CHAIRMAN: I think it might help us seeing Mr. Herring is here.

THE WITNESS: This is the amendment which was filed with the Board prior to the opening of this Session, of which we have not distributed because we had considered this to be reserved to our deliverability.

" Prairie Pipe Lines Limited has applied under an application dated April, 1950, to the Petroleum and Natural Gas Conservation Board of the Province of Alberta for permission to remove or cause to be removed natural gas from the Province of Alberta for use or consumption in the Province of British Columbia and the States of Washington and Oregon in the United States of America and offering the possibilities of an exchange arrangement for gas delivered to the Provinces of Ontario and Quebec in Eastern Canada.

The applicant has filed an amendment to this application, dated September, 1950, with the Petroleum and Natural Gas Conservation Board of the Province of Alberta. The applicant herewith submits an additional amendment to this application to bring current the proposal of Prairie Pipe Lines Limited in its status before the Alberta Board. In justification and support of this amendment the applicant submits:

1. The applicant is a body corporate duly organized under the provisions of the Companies Act of the Province of Alberta having its head office at the City of Edmonton in said Province.

2. The applicant has a contract with its parent company, Pacific Northwest Pipeline Corporation, for the

delivery of gas from a minimum volume of 100,000 Mcf. per day to the maximum requirements for the Pacific Northwest area, which gas is to be delivered by applicant to the Pacific Northwest Pipeline Corporation system at the Canadian border. This contract has been extended to cover the period reasonably assumed to be necessary to cover the present hearings before the Conservation Board.

Pacific Northwest Pipeline Corporation has proceeded with its application before the Federal Power Commission based on gas supply from two possible sources:

a. All Texas gas to be delivered to the Pacific Northwest Pipeline Corporation.

b. All gas to be supplied from reserves in Canada.

c. A combination of Texas and Canadian gas.

d. If sufficient gas is allowed to export from Alberta to supply the Pacific Northwest Pipeline Corporation offers to divert the Texas gas, now under contract from the El Paso Natural Gas Company at Dumas, Texas, to a point on the Canadian border near the City of Windsor in the Province of Ontario in Eastern Canada for applicant's delivery to the market requirements of Eastern Canada. The map attached hereto indicates the various possibilities offered by the applicant through its parent company, Pacific Northwest Pipeline Corporation.

Prairie Transmission Lines Limited, which has been chartered by special act of Parliament for the export

of natural gas, is also a subsidiary of the Pacific Northwest Pipeline Corporation, and is a participant in this amended application.

3. The names, titles and post office addresses of the persons to whom correspondence or communications in regard to this application is to be addressed are as follows: "

We mention the president and counsel.

"4. The Pacific Northwest Pipeline Corporation has established the presence of adequate markets for the sale of a minimum of 250,000 Mcf. of natural gas per day in the cities of Ontario and Quebec in Eastern Canada. They have investigated the legal problems of a reciprocal exchange of gas with the responsible agencies in Washington, D.C.

Accordingly, Prairie Pipe Lines Limited has arranged with the Pacific Northwest Pipeline Corporation that if the Alberta Board grants to the Prairie Pipe Lines Limited a sufficient volume of gas for the service of this Eastern Canadian market, this gas will be taken into the Pacific Northwest by delivery at the Canadian border to the Pacific Northwest Pipeline Corporation and Pacific will deliver an equivalent volume to Prairie at Windsor, Ontario, allowing a reciprocal exchange of gas to take place. If Prairie Pipe Lines Limited receives approval from the Alberta Government for a smaller volume of natural gas, Pacific Northwest Pipeline Corporation agrees to take such gas, down to its minimum volume of 100,000 Mcf. per day, delivered at the Canadian border,

and further agrees that at such time as Alberta does make available the larger volume they will make such delivery in Eastern Canada, subject to the approval of the various regulatory bodies.

The proposal which the Pacific Northwest Pipeline Corporation is now presenting before the Federal Power Commission in Washington, D.C., is for a 1,590 mile main line natural gas transmission system from Dumas, Texas, to the Pacific Northwest, as described in the previous applications to this Board. Until such time as Pacific Northwest Pipeline Corporation completes its case before the Federal Power Commission it is prepared to meet these agreements with Prairie Pipe Lines Limited. Following its certification by the Federal Power Commission, however, it will be necessary to amend the approved pipeline system to meet the above conditions with Prairie Pipe Lines Limited.

The applicant believes that the proposal as submitted, in which the volume of 250,000 Mcf. per day can be used to furnish complete service to Eastern Canada, closely follows the expressed position of the Alberta Government in serving Canadian cities first. The advantages to be gained in the construction of a 1,100 mile lateral line to provide this service as compared to the 2,500 mile line across Canada are quite obvious.

It is further the belief of the applicant that the approval of such a reciprocal exchange presents the only completely assured service of natural gas to this

area at this time. The plan presents an economic picture both for the markets of the United States in the Pacific Northwest and for the Eastern Canadian markets. The applicant desires to emphasize the fact that its agreement with Pacific Northwest Pipeline Corporation must be completed before that company initiates the construction of its all Texas line to the Pacific Northwest.

5. The applicant proposes entering into contracts to buy natural gas in the Province of Alberta in an amount equal to that surplus volume approved for export by the Alberta Government. The company now holds some contracts in Southern Alberta which have been filed with the Board of Conservation, but the company has been hesitant to completely commit itself until the Alberta Government expresses itself as to the area which is to be made available for export and it becomes clear which producers can participate in this export market. All of the major producers of natural gas in Alberta have stated to Prairie Pipe Lines Limited that they have natural gas for sale and will sell to Prairie if an export permit is obtained. The details of the pipeline system proposed by Prairie Pipe Lines Limited have been discussed in the previous applications.

The applicant believes, from the information presently available, that there is a surplus of natural gas to the present and future needs of the people of the Province of Alberta, sufficient to permit the granting of a permit for removal of the natural gas in the volume

as required by the applicant in connection with its project, and that the granting of such permit would be in the best interests of the people of the Province of Alberta. This would allow the Province of Alberta to begin in the participation of the Natural gas market of the Pacific Northwest, and to increase the volume of natural gas supplied as their resources developed.

6. The Pacific Northwest Pipeline Corporation, originating at Dumas, Texas, has available to it considerable market in the form of the older natural gas pipelines which start in this same area and serve the Great Lakes region of the United States. The company foresees no difficulty in selling the volumes of natural gas necessary to meet its obligations with Prairie Pipe Lines Limited.

7. Applicant considers that its proposal presents a facility for natural gas marketing to the Province of Alberta, whereby surplus gas in excess of the requirements of the Province of Alberta can be marketed in the volume that it can today supply; and further presents an unlimited future market, should the potential reserves of natural gas be developed. The applicant considers it vital to the natural gas economy of Alberta that they participate in the initial market requirements of applicant in order for it to have available a future market for natural gas.

8. It is considered vital that natural gas be immediately made available to the proposed market area of the Pacific Northwest, as the fuel requirements of

this region are extremely important to hemispheric defence. In this area are located strategic industries critical to the national defense, such industries consisting of aluminum plants, non-ferrous metal smelters, steel plants and other like industries, including the Atomic Energy Commission plants in Idaho and Washington; all of these industries and plants are to be served by applicant's pipeline system.

9. The applicant plans on obtaining its initial natural gas requirements in Canada from various fields located in the southwestern part of the Province of Alberta and/or from a grid system which it or others will construct to other fields in Alberta, the details of which will be submitted at or prior to the hearing hereon.

10. The applicant has satisfied itself that adequate financing for this project is available within the regulations of the Federal Power Commission of the U.S.A., and is now in the process of completing negotiations for its major financing requirements. Details of the commitments from all financial sources will be submitted at or prior to the hearing hereon. The applicant has available adequate funds to meet the expenses which will be incurred prior to the consummation of the major financing.

11. Estimates of total revenues to be expected from proposed facilities, total fixed charges and total operating expenses, will be shown on an exhibit to be subsequently filed and made a part hereof. This state-

ment will contain information covering the rates proposed to be charged by applicant, the expected sales and revenues to be derived.

12. The applicant respectfully subjects itself to all of the provisions of The Gas Resources Preservation Act, and respectfully requests that a permit be issued it to remove or cause to be removed from the Province of Alberta a minimum of 100 million cubic feet of natural gas per day for twenty years. "

Q MR. S.B. SMITH: Mr. Herring, you gave evidence in detail at the Hearings last year in respect to the provision of natural gas under your plans for the cities of Vancouver and Victoria?

A We did, sir.

Q That is still part of your plan?

A Very much so.

Q Would you now answer the Board and other counsel.

CROSS-EXAMINATION BY MR. NOLAN:

Q Mr. Herring, I think you made mention to Mr. Smith of an agreement to obtain Texas gas from the El Paso company?

A Yes, sir.

Q When was the agreement made?

A In July.

Q Do you know the date?

A No, sir, I do not have the contract or the letter of contract with me.

Q And who were the parties to it, Mr. Herring?

A Mr. Paul Kaiser, President of El Paso, and the officials of our company.

Q And your company being?

A Pacific Northwest Pipeline Corporation.

Q Yes. What was the amount of gas covered by that contract?

A We have an option agreement on the volume of gas. We have the right to vary from 200 million cubic feet per day to 350 million cubic feet per day.

Q At what price?

A The price will be approximately -- Mr. Kaiser is working out the final details of the cost of the added facilities to his system and we will pay the cost of those added facilities in that delivery cost.

Q The price has not been arrived at?

A As a definite basis, no. On the basis of economics we have established in our own mind what the price will be.

Q Are you in a position, Mr. Herring, to file with the Board a copy of that contract?

A I can so do at a later date. I will have to get it from Houston.

MR. S.B. SMITH: I think, perhaps, sir, I might like to consider our position in that regard. This has not been asked for previously and I think that is something to which I would like to give consideration.

MR. NOLAN: That is perfectly all right, Mr. Chairman, as long as Mr. Smith gives it consideration before we break up.

THE CHAIRMAN: You intend to file those contracts, or the contract, at the adjourned Hearing, Mr. Smith?

MR. S.B. SMITH: I do not know at the moment that I can answer. This, I think, is the first time this subject so far as we are concerned has arisen and I am not sure of the relevancy. I am not objecting at the moment, I just do not know what our position is, and I do not just want to take the position offhand about it. I would like to have the opportunity of giving it consideration without being pressed for an answer immediately.

THE CHAIRMAN: Would you like to defer that question until we do adjourn when we are going to discuss the matter of contracts?

MR. NOLAN: Yes, there is no immediate rush about it as long as the information is provided to the Board.

Q But I understand you to say, Mr. Herring, that you had arrived at an estimate of what the price would be under this contract?

A Naturally we have in establishing the economics of our project, yes.

Q And what was that price?

A Approximately 15 cents per 1,000.

Q I was going to ask you one other thing. Do I understand that you take delivery of this gas at Dumas, Texas?

A Dumas, Texas.

Q And then it is transported to Ontario?

A Provided the reciprocal exchange arrangement is made.

Q Oh, yes, as you said.

A Yes.

Q But on the line from Texas to Ontario, I take it it will pass through a territory which is in need of natural gas?

A Yes, sir, that is true.

Q Well, is there not a provision under the Natural Gas Act whereby people may make application for gas if a pipeline is passing through their vicinity?

A I am not completely familiar with our Act, but that is my understanding, yes, sir.

Q Well, now, how are you going to get this gas from Texas to Ontario if you got to drop it off along the way to anybody who makes an application for its use?

A I believe, Mr. Nolan, Colonel Weir of the Union Gas Company explained that very problem was the one that had been confronting Panhandle Eastern for some four or five years in attempting to get gas across the border to it. Our feeling on this reciprocal exchange arrangement, and it is backed, incidentally, by considerable legal advice, is that the dedication of that gas from the moment that it left its source would be for Eastern Canadian consumption based upon the fact the Pacific Northwest Pipeline Corporation was receiving the volume necessary for service to the Pacific Northwest at the Canadian border on its point and was paying for it in essence by exchanging gas to Eastern Canada.

Q Well, would it not need some statutory authority to bring this about? You see, Mr. Herring, what concerns me is that if you take this gas from Texas to Ontario and none is dropped off for the utilization of those people along the route, you are running counter to the intention of

the Natural Gas Act, but you tell me that the difficulty of that provision can be overcome by the reciprocal arrangement. I suggest to you it will take an Act of Congress to bring that reciprocal arrangement about.

MR. S.B. SMITH: I think Mr. Nolan is getting into a debate on legal questions, and very complicated legal questions. I do not doubt the competency of the witness to answer but this is a complicated legal field and I did not put Mr. Herring on the stand as an expert in law.

A I can only submit to the Board that we have investigated this procedure through legal authority in Washington, D.C., and through our own counsel in Houston and that we are convinced that it would not require more than the approval of the Federal Power Commission and the State and Commerce Departments who are also involved in any import or export of natural gas, but I submit it is the opinion of our counsel. It may vary with the opinion of Mr. Nolan.

Q MR. NOLAN: Have you got the opinion of the Federal Power Commission?

A We have not asked for a written opinion from the Federal Power Commission.

Q Have you got a verbal opinion?

A From our counsel in Washington, we have.

Q Have you anything from an authoritative source such as the Federal Power Commission?

A No, sir, and until such time as the case was actually presented I doubt that a ruling would be handed down by

the Federal Power Commission.

Q So that at the moment you do not know whether this reciprocal arrangement can be brought into effect or not?

A We can only accept the advice of counsel with respect to it.

Q Sometimes they are wrong, Mr. Herring.

MR. C.E. SMITH: Possibly.

CROSS-EXAMINATION BY MR. McDONALD:

Q I have a question, Mr. Herring. Just on the point we are discussing, Mr. Herring, is the State of California short of gas through its El Paso line?

A They are increasing their gas fields to the California Gas almost yearly.

Q There is a strong possibility the California end will have something to say about moving that gas to Ontario.

A They have a right to do so.

(Go to page 1079)

Q That could be in front of the Federal Power Commission?

A Naturally, anyone can intervene.

Q Now, coming back to Alberta, Mr. Herring, on your map that is attached to your Exhibit 33, you have set up a tentative gathering system?

A Yes, sir.

Q And can you tell me the approximate mileage of pipe that you have in that? I scaled it off and it came to about 340 miles, is that about right?

A I have not scaled it on the basis of total mileage.

Q Yes?

A Our engineers in Houston, Texas, have. I would accept your measurements there as approximately correct, Mr. McDonald.

Q Then, as I understand it, in order to supply Calgary, or the Canadian Western system, that all of the pipe to the right hand side of Claresholm would be used and useful?

A Would be what?

Q Would be used? That is your gathering system in order to supply the Canadian Western system?

A Well, that portion which could be applied to the volume of gas to meet the peak load requirements of Calgary upon delivery would be applied to that system.

Q That is right?

A Up to that time it would be solely dedicated to the service of the prairie volume.

Q And the gas you anticipate will be developed, the cost, on a demand commodity basis at Claresholm?

A On an Mcf basis.

Q On an Mcf basis?

A Yes.

Q Now, I calculated your pipe line on the right hand side of Claresholm in your scale in Exhibit 33, and it is about 245 to 250 miles?

A All right.

Q Just assuming that is so, then you anticipate having the line from Claresholm to Calgary looped as required?

A I assume that would be the method that the Company would adopt to bring it in.

Q Yes. And the distance is about 80 miles, 85 miles?

A Yes.

Q The other way to serve the same system would be to run your line from Pincher Creek to Claresholm, which would be approximately 50 miles?

A Well, if you are speaking with reference to straight pipe-lining, yes; if you are speaking of maintaining a load factor on Pincher Creek, no.

Q That is the other side of the problem?

A Yes.

Q So that the problem of maintaining the load factor at Pincher Creek is one of the real considerations in arriving at a supply for the Canadian Western system to meet this deficiency?

A We readily agree that all the statements made about Pincher Creek, we agree with all the statements made about Pincher Creek, that it is not very suitable with regard to the supply to Calgary.

Q Well, then, on that basis, too, - now can you tell me this, a pipe line from Calgary direct to Cessford would be what, approximately 100 miles? We scaled it approxi-

mately 100 miles?

A All right.

Q And a pipe line to Brooks-Bassano would be approximately 100 miles?

A Yes.

Q Now, do I understand from page 2 of your Exhibit 33, where you mention "We cannot recommend to the Board at this time a program involving additional storage for the C.W.N.G. system because of the questionable aspects of the possible reservoirs immediately adjacent to the Calgary market, the expense of experimenting with any such reservoirs", and so on - now, have you done any investigating at all of the proposed reservoirs in the vicinity of Calgary?

A In detail, no, sir. I would like to elaborate on that answer, by stating that our long experience in the natural gas business leads us to that conclusion. However, my reference to that is on a general basis, and we would not condemn the use of Turner Valley in any way as a possible future storage for Calgary.

Q I see.

.....

CROSS-EXAMINATION BY MR. MARTLAND:

Q Mr. Herring, I just have a couple of questions. There was some reference in the revised application to agreements reached with all major producers. I did not quite catch that?

A No, sir. I believe that my statement with reference to the other producers was that in discussions each of the

various companies have stated that they will sell gas to the company which receives the export permit.

MR. S. B. SMITH: Paragraph 5 of the amended application.

A In essence, I believe that was my statement. If I implied it was solely to my own company, I was doing it or putting it incorrectly.

Q MR.MARTLAND: One other question. As I understood Mr. Fisher's evidence here a year ago, it was to the effect that if an export were not granted to Prairie Pipe Lines, he proposed that Pacific Northwest Pipe Lines would carry gas to the Pacific Northwest in any event.

A That is correct.

Q And with regard to Texas?

A Yes, sir.

Q That still stands?

A Very much so.

Q Thank you.

.....

CROSS-EXAMINATION BY MR. STEER:

Q When will you be able to let us know what gas will cost at Claresholm to Canadian Western?

A Sir, with a more detailed study of this system, which is going on at the present time, and the establishment of field prices through contracts, we would apply the 6 years of depreciation on our facilities, estimate the flow of gas through that to a given local company, the cost of gas at that time, and we would ask no earnings except the 6% which is allowed both by the Board of Public Utility

Commissioners, and the Federal Power Commission in the States on our over-all equipment.

Q On what basis would you propose to charge Canadian Western?

A A straight Mcf charge basis, on the same basis as Prairie experiences its costs in regard to its Mcf volume.

Q In other words, you would have two streams of gas coming from Pincher Creek, is that right?

A No, sir. The entire supply for the C.W.N.G. system would move from those fields in the Cessford-Medicine Hat area.

Q You would have two streams, one of which would be delivered to Canadian Western and one of which would be delivered to Prairie?

A Theoretically, yes.

Q Is that right?

A One stream, but theoretically that is the idea.

Q And each of those streams would bear its own costs according to volume?

A Well, the charge would be made to the C.W.N.G. system, on exactly the same cost basis as Prairie, plus its 6% earning. The cost to Prairie would be the same as that charged to C.W.N.G.

Q Then I have a wrong conception of it if I think of two streams, one to be delivered to Canadian Western and one to be delivered to Prairie, and each bearing its own share of the costs?

A Yes, sir.

Q Is that your proposal?

A It would be the same charge to both companies.

Q Per Mcf?

A Yes, sir.

Q On the volume delivered to them?

A That is correct.

.....

CROSS-EXAMINATION BY MR.BREDIN:

Q Mr.Herring, I wonder if you would care to elaborate on the question, or at least on a question arising out of one answer given to Mr. McDonald with regard to the question of the questionable aspects of the possible reservoirs immediately adjacent to the Calgary market. I wonder if you would care to go into that word "questionable" and tell us what are the questionable aspects?

A Well, sir, I do not want to present myself as a geologist on the stand, or an expert with reference to storage. I can only point out several of those problems that were encountered in the past, and I am not offering to give expert testimony with reference to those problems. Among them is the size of the reservoir with respect to the amount of storage gas to be stored. Another is the use of a lime formation for gas storage, and the suitability of that for gas storage. There is also, of course, the question of the size of reservoir and the volume of gas you are going to store, whether you are going to have to compress it and bring it back up,and so forth. There are all those and other faftors which might be encountered, and then there is the injection and the withdrawal, which is a costly procedure, and which must be borne by that company which establishes the storage fields in the Turner Valley reservoir.

Q What would you include in the possible reservoirs immediately adjacent to the Calgary market?

A Well, we very briefly have looked at all of those within immediate economic range. By that I would mean Jumping Pound, Turner Valley, and that is just about it.

Q You would not include or you were not including the newer discoveries?

A No, sir.

Q Bailey Olds?

A There is no way to judge. We mentioned those new discoveries such as Bailey Olds as possibly affecting any storage program here in the future. It might radically change the whole picture of the C.W.N.G. system with respect to their supply. It might well give them such a surplus during the summer that they might want to get rid of the gas, but at the present time we have tried to make a recommendation to the Board based entirely upon matters which they can accept as proven and dependable.

Q Thank you, that is all I have to ask.

.....

CROSS-EXAMINATION BY MR.MAHAFFY:

Q Mr. Chairman, I have a question or two. Mr. Herring, I just would like to be sure that I understand something that you are suggesting to Mr.Steer. Now, theoretically, we have had it more or less theoretically, that the supply for Calgary, or for export, passes through a junction at Claresholm?

A Yes.

Q Now, did I understand you to tell Mr.Steer that gas at that point, Claresholm, would be sold to the Calgary system at the same price as it would be sold to the

export line?

A Well . . .

Q In other words, the price would be the same there, no matter whether it went north or southwest?

A Well, our feeling on this has been that we would have a certain Mcf charge, or cost, in our case, in order to make our 6% return when we reached Claresholm, just as when reached any point on the way to market, and whatever that price would be which would realize the pipe line company return of its service costs plus 6% earnings, would be the established cost of that gas at that point, and that gas would be available to the C.W.N.G.system at that point on that basis.

Q Yes? And it would go on to the export line on the same basis?

A Yes, it would go on to the export line on the same basis.

Q So that on your proposal then, the cost of gas to Calgary taken through its system, would be tied to the export price?

A That is correct.

Q Thanks very much.

A I think I pointed out, and I might add to that answer, that it would mean to both the export line and the market here, that there would be involved the amortization and service charges of such a system. However, in any event, we have an engineering company with considerable experience in this work, and the problem to meet was the future forecasted peak-day load for Calgary, and we could see nothing that would not overcome the question of economics for the C.W.N.G. system and this system.

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CROSS-EXAMINATION BY MR. PORTER:

Q Just one question, Mr.Herring. Where is your company drilling now in the Province?

A We are not now drilling in the Province.

Q Well, where did you drill?

A We have not drilled in the Province of Alberta.

.....

EXAMINATION BY MR. C. E. SMITH:

Q Mr. Herring, if you will refer to page 1, I guess it is, of your submission, Exhibit 33?

A Yes, sir.

Q You say "Prairie Pipe Lines Limited accept these proven areas as representing dependable reserves of natural gas, and also give serious consideration to the probable reserves as established." You are referring there to the submission by DeGolyer & McNaughton?

A Yes,sir.

Q When you say "Prairie Pipe Lines Limited accept these proven areas", can you give me a little more information about what you mean there?

A Well, in establishing this presentation, or the basis for this presentation, we accepted the proven areas of these fields, which are included in this submission, as presented by DeGolyer & McNaughton. We went further in two cases to include a portion of their probable reserves, but we retained a margin of proved reserves in the other two fields in that area, and have considerable proved reserves in excess of actual requirements in Pincher Creek. I think

we have actually kept a margin of safety in this would-be deliverability schedule on the basis of proved reserves.

Q Does the word "accept" signify anything more than to say that you use their figures?

A Nothing more.

Q Pardon?

A Well, I think the problem before the Board here or has been one as to what they must acknowledge as acceptable in establishing what is acceptable to the Province of Alberta, and the statement of Prairie Pipe Lines here is that we accept these proven areas.

Q Does Prairie Pipe Lines agree with the figures submitted by DeGolyer & McNaughton, is that what we are to take from that?

A We certainly do.

Q Pardon?

A We certainly do.

Q Are we to understand that the word "accept" means "agree" also as well as its ordinary usage?

A We certainly do.

Q With regard to your probable, and maybe you were going to mention this, in predicting your field performance in the preparation of your deliverability schedules, have you taken only proven volumes or have you included probable in any case?

A We have accepted only proven gas in this deliverability schedule with the exception of those two fields which I mention.

Q And those are what?

A Countess-Brooks and Princess-Patricia.

Q And in those cases what did you do, Mr. Herring?

A We have still a margin above that which we actually have forecast which we have shown in Cessford and Medicine Hat, which would more than protect the excess we are getting or cutting away from the proven area.

Q And those are the two exceptions?

A Yes.

Q If you will refer to page 2, Mr. Herring?

A Yes, sir.

Q This is merely a matter of clarification. Two gentlemen have talked to you about possible reservoirs. I notice that you used the plural "reservoirs". Did you have anything in mind except Turner Valley?

A No, sir, that is the only readily available reservoir. On down the road with depletion Jumping Pound might be considered.

Q I mean, did you have presently in mind anything but Turner Valley when you used the term "reservoirs", and used it in the plural?

A No, sir.

Q And I think that you told somebody else that that is a matter for geologists to discuss rather than yourself, is that right?

A Yes.

Q On that same page you say "recent discoveries north of Calgary which may materially affect any storage program". I assume that is Bailey Olds that you are talking about?

A Yes, Bailey Olds, primarily.

Q Just as a matter of clarity?

A Yes.

Q And then you continue further down on that page, "Any such program involving large expenditures cannot be recommended at this time because of the many unknown factors and the period of nearly 10 years which must elapse before these facilities could be utilized by the local company." I think I know what you mean by that, but would you briefly tell me what you do?

A Yes, sir. Our meaning in that statement was with reference to the storage possibilities adjacent to Calgary, when the established shortage of peak-day supply is fixed by the Board.

Q About 1960?

A Yes.

Q That is what you had in mind when you said that?

A Yes.

Q Then you refer to the reserves in the areas between Cessford and Medicine Hat?

A Yes, sir.

Q By name what are they?

A The Countess-Brooks area and the Princess-Patricia, and then on down to Suffield before reaching Medicine Hat.

Q Those are the ones?

A Yes.

Q When you say "between" those, I take it that Cessford is eliminated, or is that included?

A That is included in our submission.

Q That is what I thought, and I was wondering if this were word "between" included Cessford?

A Well, it includes Cessford as well.

Q And any place where you have referred to figures such

as 1½ trillion, 2½ trillion cubic feet, and so on, you are still referring to the DeGolyer-McNaughton submission, is that correct?

A That is correct.

Q For instance, on page 3 you say, "The combined proved reserves of these areas now exceeds 2½ trillion cubic feet of natural gas"?

A That is correct. In every case except where we have re-added the presently connected reserve figure of the C.W.N.G. system, and those are the Board's figures.

Q But otherwise where you use that general statement it is still a reference to the DeGolyer-McNaughton figures.

A The proved figures of DeGolyer & McNaughton.

Q The proved figures of DeGolyer & McNaughton?

A That is correct.

THE CHAIRMAN: Mr. Smith, will Mr.Herring be here on Monday?

MR. S.B. SMITH: I am not certain whether he will be or not, but I can ask him.

A Yes, I will be.

THE CHAIRMAN: I was thinking of adjourning a little earlier than 4 o'clock. Have you got much more, Mr.Smith?

MR. C. E. SMITH: I have a lot of things which will take more time to look up in my notes more than anything else. There is one question I would like to ask, but then there is also the Board, and I understood that Mr. Herring wanted to leave.

Q DR. GOVIER: Were you planning to be here on Monday in any case, Mr. Herring?

A I have not fully decided, but I will decide and be here now,

yes, sir.

MR. C. E. SMITH: I understood he wanted to get away and I was trying to hurry along.

THE CHAIRMAN: If Mr. Herring is going to be here Monday I think we can adjourn now.

MR. C. E. SMITH: The people from Edmonton will be happy to hear that.

THE CHAIRMAN: We will adjourn until 10.15 Monday morning, and reconvene in the Criminal Court Room. There has been a re-arrangement of Court sittings, so that we will meet at 10.15 on Monday morning in the Criminal Court Room.

(Hearing adjourned until 10.15 A.M. October 1st, 1951).

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The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

Application for Permission to Remove or cause to be removed Natural Gas from the Province of Alberta, under the Provisions of the Gas Resources Preservation Act by Prairie Pipe Lines Limited.

I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session:

Volume_____